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International Journal of Engineering and Applied Sciences ler has been published in Turkish and English since 2018 with 2 issues. Our journal will accept Turkish and English articles as 2 issues a year and the articles will be evaluated by at least two referees with the same system. Our magazine from December 2018; it offers many advantages to readers due to the practical and practical access to the authors as well as the process of publishing and publishing quickly and easily; The electronic journal (e-ISSN:2667-4165) accepts 2 numbers per year (June and December) in Turkish and English. The names of the judges evaluating the articles are not notified to the authors. The referees cannot see the names of the authors. The studies are evaluated as at least two referees. Our authors, who want to send articles, can register their original scientific articles online and follow the process by registering on our magazine page. Our journal is accepted as original and previously published research articles.

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BAKIR ORE YALITIM ATIKLARINDAN BAKIR BAKTERİLERİNİN BAKTERİYEL LEVHA EDİLMESİ

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Zhezkazgan University named after O. Baikonurov
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Özet

1. Introduction

In recent decades, many non-ferrous metal deposits located in developed areas have been depleted in favorable geological, climatic and transport conditions. The depletion of mineral resources at these sites, the increasing severity of economic and social problems, the tightening of environmental requirements and the energy difficulties of recent years require the search for new technological solutions [1].

Intensively conducted research in the field of biohydrometallurgy allows us to involve in the processing of huge reserves of off-balance sheet and waste ores, as well as middling and waste of processing plants. The well-known data in this area is sufficient to assume that the biological method is one of the most promising in the field of processing of poor ores and other sources of non-ferrous metals. This method is economically beneficial, eliminates environmental pollution and
provides integrated use of mineral raw materials [2].

Of particular danger are flotation dumps and waste dumps of deposits, where the destruction of ore minerals on the surface of substandard ore and overburden occurs. The oxidation of sulphides produces soluble salts of iron, zinc, copper, cadmium, lead, sulphate ions. Mining industry waste is a man-made object that, in accordance with existing legislation, can be considered as a potential resource. Therefore, testing unconventional ways of recycling enrichment wastes and creating new technologies on their basis are urgent tasks. Their solution will allow the use of environmentally friendly microbiological methods in the mining industry in the region. The biological leaching of sulfide ores is a complex, multi-step process in which the release of metals into solution is accompanied by the sequential oxidation of sulfide sulfur contained in minerals to elemental sulfur and sulfates. Separate reactions can be carried out as one type of microorganisms, possessing a universal set of enzymes, and an association of several more specialized species [3].

The current period is characterized by the fact that all over the world complex geological and technological studies of raw materials of technogenic objects are carried out in technologically and economically efficient ways to engage in efficient processing of raw materials, resulting in comprehensive information on the quality and quantity of accumulated technogenic mineral resources in them are useful components and impurities, and other data that fully characterize the technogenic formation, as about CPC implementation perspective geotechnologies [4,5].

2. Status of the issue and review of scientific articles

The tailing of the Zhezkazgan concentrator (ZHOF) is located in the Karaganda region, 6 km south-east of the city of Zhezkazgan. Tailings were stored in the period from 1964 to 2007. During this period, 852,813.51 thousand tons of tailings with an average copper content of 0.128%, silver - 2.46 g/t were accumulated in the tailing [6].

<table>
<thead>
<tr>
<th>Cu</th>
<th>Fe</th>
<th>Ca</th>
<th>Si</th>
<th>Al</th>
<th>Zn</th>
<th>Ag, t/т</th>
<th>Ti</th>
<th>S</th>
<th>Mn</th>
<th>Cr</th>
<th>Pb</th>
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<td>0.12</td>
<td>2.90</td>
<td>2.92</td>
<td>28.94</td>
<td>6.21</td>
<td>0.067</td>
<td>2.13</td>
<td>0.31</td>
<td>0.36</td>
<td>0.13</td>
<td>0.017</td>
<td>0.082</td>
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Table 1. The chemical composition of the source tails Zhezkazgan processing plant,% [6].

<table>
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<th>The name of the connections</th>
<th>Content,%</th>
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<td>Oxidized compound</td>
<td>0.03</td>
</tr>
<tr>
<td>Secondary sulfides</td>
<td>0.09</td>
</tr>
<tr>
<td>Primary sulfides</td>
<td>&lt;0.01</td>
</tr>
<tr>
<td>Total</td>
<td>0.13</td>
</tr>
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</table>

Table 2. Phase composition of the sample of stale tails of the Zhezkazgan concentrator on the forms of copper compounds [6].
many combined schemes, it can be used for processing ores, concentrates and tailings, sludge, slags containing sulfides of non-ferrous metals and other minerals oxidized with ferric iron, and elemental sulfur, for example, to improve the quality of molybdenum concentrates, selective extraction copper, zinc, nickel minerals, removal of impurities from mineral products such as arsenic, antimony, sulfur, for leaching of uranium [7].

We reviewed the scientific articles of several authors in 2017 on the topic of bacterial leaching of copper from enrichment tailings.

An international group developed a two-step protocol for leaching and extraction of metals to extract copper from tailings currently in Spain and Serbia. The most effective extraction of copper (from 84 to > 90%) was achieved by bioleaching tails at 45 °C using a specific microbial consortium, where elemental sulfur was added to the tails, and the pH of the leach solutions allowed to drop to ~ pH 1, into which anaerobic were introduced conditions. The heat-resistant acidophils Acidithiobacillus caldus and Sulfobacillus thermodiastoxidoxidans appeared as the dominant bacteria present in both filtration filters under these conditions. Copper was then precipitated as a sulfide phase using hydrogen sulfide formed in a sulfide bioreactor with a low pH (4.0) [8].

The main goal of some work groups was to determine the optimal bacterial association of several bacterial strains for leaching copper from chalcopyrite. The main related species of bacteria involved in the bioleaching of sulfide ore (Acidithiobacillus ferroxidans, Acidithiobacillus thiooxidans, Leptospirillum ferroxidans and Leptospirillum ferrooxidans) have been established. It was found that the association with At. ferroxidans and At. thiooxidans emit 70% of copper in 35 days from selected ore, which indicates significant differences with other associations, which isolated only 35% of copper in 35 days [9].

A thin layer heap leaching of copper flotation tailings containing high levels of fine grains was carried out on mixed cultures on a small scale for 210 days. The results showed that the chemolithotrophic genera Acidithiobacillus and Leptospirillum were always present and dominated in the microbial community in the initial and middle stages of the heap bioleaching process; both kinds may be responsible for improving copper recovery. However, the titers of Thermogymnomonas and Ferroplasma gradually increased in the final stages. [ten].

Protocols and methods are being actively worked out. So when recovering copper from low-grade sulfide ore of copper, it was found that several parameters affect the bioleaching of copper; among them pulp density and nutrient media selected for research. 5 g / ml, mixed mineral salt medium Acidithiobacillus thiooxidans (70 vol.%) and Acidithiobacillus ferroxidans (30 vol.%) and 10% inoculum. Under these conditions, the maximum ability of the bioleaching medium for the extraction of copper was determined by about 99%. [11].

The preliminary preparation of chalcopyrite ground in a ball mill is considered. The initial samples (obtained) were thermally activated (600 °C, 30 minutes) to notice a change in the physicochemical and mineralogical characteristics enclosing rock, and then the effect of this on copper recovery. The study showed that thermal activation leads to volume expansion in the rock with the development of cracks, micro- and macropores on its surface, which allows the bacterial solution to more easily penetrate into the body, which contributes to enhanced dissolution of copper [12].

2. Conclusions

The relevance of the topic of the proposed research is evident, as it is in the trend of the development of technologies and approaches in the matter of bacterial leaching of metals, copper in particular.

More than 100 firms in 25 countries are involved in the development of microbiological leaching processes. The advantage of the biotechnological method in comparison with the pyrometallurgical and autoclave ones is confirmed by the intensive introduction of biohydrometallurgical technologies in the production of gold from gold-arsenic materials. The task of the present time is to create a competitive, resource-saving and environmentally friendly production of non-ferrous metals using leaching. The method is easily automated and is able to completely
transform the entire technological chain of modern mining and processing of metal ores, to make it environmentally friendly and to achieve the highest indicators for the integrated extraction of useful components. Systemic development and implementation of the technology of biological leaching of metals in Kazakhstan would sharply increase the competitiveness of Kazakhstan copper and other metals in the world market by reducing costs. The environmental component is also very important - it will be possible to abandon ore mining and by the open-pit and mining method, ore processing using the flotation method, and abandon the pyroprocess. That is, the modification of the environment is excluded, pollution of the biosphere is ceased by solid, liquid and gaseous emissions and waste.

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Kompozisyon Değişiminin Geopolimer Köpük Beton Temel Özelliklerine Etkisi

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Özet


Effect of Composition on Geopolymer Foam Concrete Basic Properties

Abstract

Geopolymer technology provides a new and good solution for avoiding the negative effects of environment and ecology on the use of fly ash. Natural minerals and inorganic polymers which can be produced by reaction of aluminosilicate minerals such as fly ash, blast furnace slag, etc. in the alkaline environment were usually formed by NaOH and sodium silicate. In this study, fly ash was used as basic Geopolymer material. Hydrogen peroxide was used as the foaming agent. Different sample series were prepared by changing the mixing ratios of fly ash and blast furnace slag. Physical and mechanical properties were tested. Mineralogical and micro structural characterizations were carried out by XRD and SEM techniques. Increasing blast furnace slag addition caused crack formation. The addition of large aggregates significantly reduced drying shrinkage and prevented crack formation. Likely, it was observed that the coarse aggregate addition contributed to reduce the density of geopolymer foam concrete blocks.

1. Introduction

The development of new binders, as an alternative to traditional cement and concretes, by the alkaline activation of industrial by-products (i.e. amorphous ground slag and fly ash) is a relatively new area and research topic for the scientific community (Puertas et al. 2003). Use of alkali activated materials in concrete manufacturing has environmental benefits because its production requires less energy than ordinary Portland cement (OPC) and utilises industrial by-products. They have
superior durability in aggressive environments compared to OPC (Tatiana Bakharev, Sanjayan, and Cheng 1999b). On the other hand, Ordinary Portland cement (OPC) contributes significantly to the global CO$_2$ emissions. Approximately 50–60% of OPC-production-related CO$_2$ emissions are released from the calcination (decarbonation) of limestone at 1400–1450 °C (Damtoft et al. 2008) (Davidovits 2015). It is worth pointing out that the reduction of anthropogenic CO$_2$ is now an urgent goal because many scientists estimate that the concentrations of CO$_2$ and other climate forcing substances in the atmosphere already exceed the safe level (Van Deventer, Provis, and Duxson 2012). Consequently, the development of alternative low carbon binders is recognized as one option to reduce CO$_2$ emissions (Gartner and Hirao 2015).

The innovation of geopolymers relates to the possibility to harden at room temperature without high treatment temperature and consequently reduced CO$_2$ emissions, representing an eco-friendly innovative alternative to cement. The term “geopolymer” describes a family of mineral binders that have a polymeric silicon–oxygen–aluminium framework structure. The formation of geopolymers requires reactive precursor materials and a high concentration of the reagents (especially of OH) (Provis and Van Deventer 2009). Geopolymer chemistry generally involves mechanisms such as dissolution of silicates and aluminates in a strongly basic medium, followed by polymerization of surface active groups of particles with the dissolved species to form a solid geopolymer structure. This consists of a network of more or less amorphous SiO$_4$ and AlO$_4$, where silicon and aluminum are in IV-fold coordination with oxygen. The presence of alkaline ions such as Na$^+$, K$^+$, Li$^+$ in the network is necessary to compensate the negative charge of Al$^{13}$ in IV-fold coordination (Ph. Davidovits 2008) (Phair and Van Deventer 2001) (T. Bakharev, Sanjayan, and Cheng 1999). Geopolymers give the potential possibilities to prepare inorganic bonds and building materials from the waste as blast furnace slag, fly ash, kaolinitic substances, etc (Davidovits J. 2008). Geopolymers are important materials which could be used to replace concrete and some other industrial materials. They possess many favourable properties such as rapid setting and hardening, good long-term properties and durability (T. Bakharev 2005). Thanks to these attractive properties this technology is receiving increasing attention in different application fields like refractory filters, lightweight panels for thermal and acoustic isolation, low cost ceramics and fire protection structures (Toniolo and Boccaccini 2017). Fly ash (FA) is the most used and suitable waste material in geopolymerization due to the huge amount produced worldwide, estimated to be around 780 million tons annually and its great workability (Duan, Yan, and Zhou 2016). The geopolymer technology provides a new good and green solution to the utilization of fly ash, avoiding its negative impact on environment and ecology. Fly ash is generally regarded as a good source material because it is the residue from burning coal in a thermal power plant and consists mainly of silica and alumina. Fly ash has a complex microstructure comprising a mixture of amorphous and crystalline components. The structure and physical properties of fly ash geopolymer are dependent upon a variety of parameters including water content, thermal history, particle size, and the degree of amorphicity (van Jaarsveld, van Deventer, and Lukey 2003).

Shrinkage of concrete at early age is generally considered as a critical parameter for durability design of concrete structures (Tatiana Bakharev, Sanjayan, and Cheng 1999a). Drying shrinkage is a major reason for the deterioration of geopolymer structure and it is interested to discuss (Wongkeo, Thongsanitgarn, and Chaipanich 2012). Most studies of alkali-activated fly ash/slag have focused on microstructure and mechanical properties whereas shrinkage characteristics of alkali-activated fly ash/slag blended mortar and concrete have been investigated very little. Slag addition to a fly ash affects the shrinkage of a fly ash/slag binder. The lack of research on shrinkage may actually result in some problems for practical applications (Lee, Jang, and Lee 2014). It is well known that drying shrinkage is an everlasting process when
concrete is subjected to drying conditions; this can be explained by the loss of water held in capillary pores of cement paste. It was revealed that the drying shrinkage of concrete progresses with the increase of its unit water content or water/dry mix ratio, which has been referred to as the major factor affecting the drying shrinkage properties (Zwang, Zakita and Hama 2013). In addition that Hansen reported that the coarse aggregate has an influence on the long-term drying shrinkage of concrete. The aggregates play an important role in restraining the shrinkage of the matrix, which could reduce the shrinkage of concrete (Hansen 1987). The aim of this study was to develop geopolymer by preventing drying shrinkage in view of potential applications in the field of thermal insulation. The geopolymeric matrices were prepared using different proportions perlite as a coarse aggregate.

2. Material and Method

Fly ash (FA) was obtained from the Seyitömer Thermal Power Station Turkey and XRD analysis is given in Figure 1. Blast furnace slag (BFS) was also used in the geopolymer mix. It was taken from Karabük Iron and Steel plant Turkey. In order to examine the effect of perlite addition samples were prepared. The composition of the samples was given in Table 1. Additive amount was given as wt percentage amount of fly ash and blast furnace slag. Alkali activator solution was prepared by mixing 10 M NaOH solution with sodium silicate solution. H$_2$O$_2$ (50% concentration) was used in experiments as foaming agent. Foam stabilizer (FS) was used in order to obtain foam stabilization and prevent collapsing of the samples.

![Figure 1. XRD pattern of fly ash.](image)

Chopped short polypropylene fibres were used to prevent early shrinkage of the cast sample. First liquid part of the mixture was prepared and then solid part of the mixture was added. The sodium hydroxide flakes were dissolved in water to make a solution. The sodium hydroxide and the sodium silicate solutions were mixed together and then added to dry materials and mixed for about five minutes. After mixing in shear type mixer, samples were casted into the 100x100x100 mm plastic moulds. Samples were cured at 60 °C for 24 hour to obtain faster geopolymerization.

Two types of sample were produced based on low and high FS content. Mix design of the samples is given at Table 1. Additive amounts were given as percent weight of total weight of FA+BFS. Bulk density of the samples was calculated by simply dividing weight of the samples to volume. Compressive strength measured along the foaming direction.

<table>
<thead>
<tr>
<th>Main Components</th>
<th>% wt</th>
</tr>
</thead>
<tbody>
<tr>
<td>FA</td>
<td>90</td>
</tr>
<tr>
<td>BFS</td>
<td>10</td>
</tr>
<tr>
<td>Total</td>
<td>100</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Additives</th>
<th>Wt % of Main Components</th>
</tr>
</thead>
<tbody>
<tr>
<td>FS</td>
<td>0-0,70</td>
</tr>
<tr>
<td>Sodium silicate sol.</td>
<td>50</td>
</tr>
<tr>
<td>10 M NaOH</td>
<td>63</td>
</tr>
<tr>
<td>Polypropylene fiber</td>
<td>0,2</td>
</tr>
<tr>
<td>Perlite (expanded)</td>
<td>0-2,5</td>
</tr>
</tbody>
</table>
3. Results and Discussions

Drying cracks are the main problem for cellular concrete structures. Fiber and larger aggregate addition usually prevent the cracking problems. Figure 2a. shows the high shrinkage amount at samples which have no expanded perlite content. When expanded perlite was added to the mixture, shrinkage was prevented and better foaming was observed (Figure 2b.)

![Figure 2.](image)

Figure 2. High shrinkage without perlite addition (a.) and lower shrinkage at perlite addition (b.)

All samples were dried at the laboratory conditions. Every day weight of the samples was measured. Calculated density vs. time graphic was drawn (Figure 3). Perlite containing samples reached the constant weight after eleven days. Samples which do not have perlite showed similar drying curve.

![Figure 3.](image)

Figure 3. Drying rate of the perlite containing samples.

Bulk density of the samples strongly depends on the foam stabilizer and perlite amount. Bulk density decreased with increased expanded perlite addition. Porous nature of expanded perlite results in decrease in the bulk density. The study shows that, bulk density of the foam samples strongly depends on the FS to $\text{H}_2\text{O}_2$ ratio. Addition of larger perlite particles and PP fibers together is very successful for the prevention of drying cracks of the geopolymer foam concrete. Porous structure of the expanded perlite particles also decreased the bulk density of the geopolymer foam. Correct
selection of FS to H$_2$O$_2$ ratio is also important for the defect free sample production. Improper ratio selection resulted in collapsing of the foam samples. 

Geopolymerization temperature was also important factor for the production of defect free geopolymer foam samples. Geopolymerization temperature higher than 60 °C increased the risk of drying crack formation and resulted in higher shrinkage. On the other hand lower geopolymerization temperatures decreased the foaming ability of the mixtures and lower geopolymerization rate. It is well known that the foam generation ability of the H$_2$O$_2$ increases with increased temperature.

According to TSE 13655 standards, geopolymer foam concrete masonry units must have minimum compressive strength of 1.5 MPa. Measured compressive strength of the geopolymer foam samples conform to the standard values. Foam structure and bulk density are the main factors that affect the compressive strength of the geopolymer foam samples. Expanded perlite addition decreased the strength of the geopolymer foam samples. Porous nature of the expanded perlite is the main reason for strength reduction. Figure 4 shows the compressive testing of samples and the resulted cracking patterns. Geopolymer foam samples did not collapse completely after the compressive testing. Although polypropylene fiber addition was useful for the early shrinkage reduction, its addition also affects the strength behavior of the geopolymer foam samples.

4. Conclusion

Geopolymer foam concrete blocks were successfully produced from fly ash and blast furnace slag without any cracks. Effect of different amount of foam stabilizer and expanded perlite addition was investigated. Expanded perlite addition decreased the cracking tendency of the geopolymer foam concrete.

Excellent bonding was observed between expanded perlite particles and geopolymer foam matrix. Foam stabilizer to H$_2$O$_2$ ratio is very important for pore size and bulk density. When foam stabilizer amount increased, pore size of the geopolymer foam was decreased.

Geopolymerization temperature must be correctly chosen for crack free samples. High geopolymerization temperatures resulted in cracks. On the other hand, low geopolymerization temperatures resulted in weak foaming and higher bulk density.

All samples reached to constant weight after 11-12 day drying under laboratory conditions. Compressive strength of the geopolymer foam concrete samples conforms to minimum strength requirements according to the TSE 13655.

Polypropylene fiber addition was successful for the elimination of the shrinkage cracks, but at the same time its addition increased the compressive strength by simple fiber strengthening effect.

Acknowledgements

Authors wish to thanks to Pana Elemente Foam Concrete Block Co. for supplying of the chemicals.

5. References

Elevation Temperature Curing on Properties of Alkali-Activated Slag Concrete."


TSE 13655 Specification for masonary units- Foamed concrete masonary units. 2015.


A designed breathalyzer machine for workplaces and alcohol drinking places

Abstract

It is determined that the alcohol content of the drivers is measured by the breathalyzer. The result of the measurement shows the ratio between the alcohol content and the amount of blood in terms of promil. Promil shows how many milligrams of alcohol in every hundred milligrams of blood. In this study, an Arduino microcontroller-based alcohol-meter device is designed. This device is intended to be installed in places such as alcohol-drinking places such as pubs and working with a coin reader. A device has been developed for people who drink alcohol to measure their alcohol levels with a pipette blow. The accuracy of the device was compared with the alcohol-meter devices used in the market. As a result of the measurements, accuracy analyses were performed and the error remained less than 3% in all cases.

1. Giriş

Alcohol use which causes millions of people to lose their lives is a serious problem. Although it is a causal factor of many serious diseases, it is also the cause of the events that cause violence and injury consequences in cases of overuse. Especially in terms of drivers driving along with the use of vehicles, it is seen as a damaging element to the other members of the society.

According to a report published by the World Health Organization (WHO), more than 3 million people died in 2016 as a result of harmful alcohol use.

In general, the harmful use of alcohol causes more than 5% of the global disease burden. Alcohol is a
A major public health problem in most of the traffic accidents.

According to data from the World Health Organization, approximately 1.2 million people worldwide die as a result of traffic accidents. Even a small amount of alcohol consumption increases the risk of accidents for drivers and pedestrians. Alcohol not only disrupts the critical processes for safe road use, such as vision and reaction times, but is also linked to the judgment of judgment, and is therefore often linked to other high-risk road-use behaviors, such as using or using a seat belt. It should be noted that the number of traffic accidents caused by alcohol in our country is too high (Organization, 2007; Organization & Unit, 2018). One of the most important elements of the modern world is transportation. With increasing technology, passengers are provided with more comfortable vehicles in road transport. However, according to the report of the world health organization, approximately 1.2 million people lost their lives in 2016 in the traffic accidents occurring worldwide (Organization & Unit, 2018). Traffic accidents for societies, families and people, together with social problems, bring a heavy burden on health services and economies (Organization, 2007).

It is a rapidly growing problem in traffic accidents with the increase of motor vehicles on highways. Especially the most dramatic situation for injuries and fatal accidents is the vulnerable citizens in the traffic. The factors affecting the way in which alcohol, drugs and other people are exposed to traffic cause the death of others and the death of others. According to the research reports, it has been shown that alcohol consumption negatively affects driving skills such as cognitive performance and decrease in impulsive behavior and distraction due to alcohol use (Kesen, 2004).

In our country, the Law No. 2918 on the use of vehicles under the influence of alcohol and stimulants has been defined. According to Article 48 of this law, drivers who have been drinking alcohol, stimulants or drugs are not allowed to drive on highways.

Technical devices are also used to determine the amount of alcohol in the blood by security forces (amaçyla Highway Traffic Law, oll 2005).

As a result of the measurements carried out by the private car drivers, the amount of alcohol in their blood is above 0.50 promil is prohibited in accordance with the law on road traffic regulations. Similarly, for other vehicle users, this limit is 0.20. In this context, alcohol audits are carried out by law enforcement officers in order to ensure traffic safety.

In this study, a coin operated alcohol meter device has been developed for citizens who want to check the amount of alcohol in places like entertainment venues etc. The device is activated with the discard of the money and the person who wants to make alcohol measurement by a pipette blow to the alcohol sensor can learn the necessary level of promil lcd screen.

2. Material ve Metod

In this study, open source Arduino microcontroller is used. Various analog inputs can be read with arduino microcontrollers, light, sound etc. on a sensor. information can be converted to output. From engine control to lighting systems. Arduino can be used in many projects ranging from daily application projects to complex scientific studies. In this way, there is incredible accessibility information that will provide great help for those who need it, with widespread use throughout the world (IntKyn. 1).

2.1 System Components

In this section, information will be given about the design, installation and operation of coin operated coinmeter system with coin acceptor to be used in workplaces and entertainment venues realized with Arduino microcontroller card. The Arduino board consists of a gas sensor, an LCD display and a coin acceptor assembly. It is a great advantage that Arduino cards can be used with many sensor types.
With these sensors, anything can be detected or measured. In addition, the overall use of sensors is both easy and inexpensive.

One of these sensors is the MQ-3 gas sensor that detects alcohol. The MQ-3 gas sensor is a sensor that tests the levels of alcohol, gasoline, hexane or LPG in the air, but is most commonly used as an alcohol breath analyzer for a person who drinks vodka, wine, beer or another drink (Sahuet al. 2017). The circuit diagram of the built-in meter is shown in Figure 1.

![Alcoholmeter circuit diagram](image)

**Figure 1.** Alcoholmeter circuit diagram

ArduinoUno is a micro controller card based on ATmega328P. There are 14 digital input / output pins. 6 of these pins can be used as PWM output. It also has 6 analog inputs, 16 MHz quartz crystal, one USB connection, one power input, one ICSP header and one reset button. It can be connected to the computer with a USB cable to operate, or can be operated with an AC / DC adapter or battery. It is the most widely used product of the entire Arduino family (IntKyn. 2).

The ArduinoUno microprocessor card allows employees to develop systems in this area. Open source electronic prototyping is a convenient platform for easy-to-use hardware and software. It is connected to the MQ-3 sensor, which depends on factors such as the number of measurements carried out in sequence with analog inputs. The sensor is made by measuring the alcohol concentration that matches the equivalent of milligrams of alcohol per liter of water connected to the serial port 3. This heater of the sensor should rise up to 40 ° C (Özekinci and Öztürk 2017). The temperature reaches the desired value within a few minutes after the sensor is reached. The sensor is in a mold made of plastic and stainless steel mesh. Here, the heater provides the necessary operating conditions for the operation of sensitive components. The MQ-3 gas sensor has 6 pins. Four of them are used to receive the signal and the other 2 to provide the heating current. The algorithm of the study is shown in Figure 2.

![System working algorithm](image)

**Figure 2.** System working algorithm

3. Results
Design and production of the alcohol meter is shown in Figure 3. Measurements were made for alcohol test. As a result of the measurements performed, the correct and successful result values were seen on the LCD screen.

![Figure 3. Alcoholmeter](https://store.arduino.cc/usa/arduino-uno-smd-rev3)

**4. Discussion and Conclusion**

The results of the study were compared with the alcohol meter devices used in the market. The comparison results are based on a pre-stimulation system for individuals who have been drinking alcohol in areas with alcoholic entertainment that may endanger driving safety. With this control system, a cheap and reliable practical test facility was obtained. With this system, the rate of accidents can be reduced by predetermining the accidents caused by alcohol.

**5. References**

Highways Traffic Law. (2005), (1).


**Internet kaynakları**

Gaz Metal Ark Kaynaklı Zırh Çeliklerinin Mekanik Özelliklerinin Belirlenmesi

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Geliş Tarihi:15.09.2018 ; Kabul Tarihi:30.10.2018

Özet

Armox zırh çeliği geleneksel olarak askeri uygulamalar için kullanılmaların yanı sıra günümüzde sivil uygulamalar içinde kullanılmaktadır. Armox zırh çelikleri yüksek sertlik ve mukavemetle birlikte mükemmel balistik özelliklere sahiptir. İyi aşınma direncine sahip olan bu çelikler düşük karbon eşdeğerine sahip olduklarından iyi derecede kaynak edilebilirliğe sahip oldukları bilinmektedir. Endüstriyel uygulamalar zırh çeliklerinin birbirleriyle ve farklı cins çeliklerle kaynak edilebilirliklerine ihtiyaç duyduğundan göstermektedir. Bilhassa farklı cins çelik birleştirilmelerinde kullanılan kaynak yöntemi ve kaynak parametreleri yanı sıra, koruyucu gaz ve doğru ilave metalin seçimi de birleştirme kalitesini önemli derecede etkilediği bilinmektedir. Bu çalışmada Armox 500T–Armox 500T aynı cins zırh çelik çifti ve Armox 500T-AISI 304 farklı cins çelik çiftinin gaz metal ark kaynağı kabiliyetlerini ayrıntılı olarak incelenmiştir. Sonuç olarak; Armox 500T–Armox 500T aynı cins zırh çelik çifti ve Armox 500T-AISI 304 farklı cins çelik çiftinin gaz metal ark kaynak kabloylarını ayrıntılı olarak incelenmiştir. Sonuç olarak; Armox 500T–Armox 500T aynı cins zırh çelik çifti ve Armox 500T-AISI 304 farklı cins çelik çifti önemsiz paslanmaz çelik ER307 ilave metal ile uygun kaynak parametreleri seçilerek, robotik gaz metal ark kaynak yöntemiyle başarıyla birleştirilebilmektedir.

Determination of the Mechanical Properties of Gas Metal Arc Welded Armox Steels

Abstract

Armox protection plate is traditionally used for military applications, and in today’s world it is also used for civil applications. Armox has excellent ballistic properties in combination with high hardness and strength. Armox steels having good abrasive wear resistance has got low carbon equivalent so it is known that they have good weldability. Industrial applications show the need for weldability of armor steels with each other and with different types of steels. Especially, in addition the welding method and welding parameters, the shielding gases and selecting of the right welding consumable also affect significantly to the weld quality of dissimilar steel weldment. In this study, the gas metal arc welding capabilities of Armox 500T-Armox 500T steel couple and Armox 500T-AISI 304 dissimilar steel pair was investigated in detail. As a result; Armox 500T–Armox 500T similar armor steel couple and Armox 500T-AISI 304 dissimilar steel couple can be joined with austenitic stainless steel ER307 filler metal by using robotic gas metal arc welding method selecting appropriate welding parameters.
2.1 DeneySEL MALZEME VE SCHAFFLER diyagramı
Bu çalışmada, 4,5 mm kalınlığında Armox 500T zırh çelikleri ile 4 mm kalınlığında AISI 304 paslanmaz çelik çifti GMAK yöntemi ile argon koruyucu gaz kullanılarak 1.2 mm çapında AWS A5.9 standartına göre ER307 ilave tel ile birleştirilmiştir. Deneyle kullanılan ana malzeme ve ilave tel kimyasal bileşimleri Çizelge 1'de verilmiştir.

Çizelge 1. Ana malzeme ve ilave tel kimyasal bileşimi (% ağırlık)

<table>
<thead>
<tr>
<th>Alaşım</th>
<th>C</th>
<th>Mn</th>
<th>Si</th>
<th>Cr</th>
<th>Ni</th>
<th>Mo</th>
<th>S</th>
<th>P</th>
<th>Fe</th>
</tr>
</thead>
<tbody>
<tr>
<td>Armox 500T</td>
<td>0.2</td>
<td>0.8</td>
<td>0.24</td>
<td>0.5</td>
<td>0.9</td>
<td>0.37</td>
<td>0.003</td>
<td>0.004</td>
<td>Kalan</td>
</tr>
<tr>
<td>AISI 304</td>
<td>0.08</td>
<td>0.04</td>
<td>0.09</td>
<td>18.4</td>
<td>7.9</td>
<td>0.04</td>
<td>0.01</td>
<td>0.03</td>
<td>Kalan</td>
</tr>
<tr>
<td>ER307</td>
<td>0.08</td>
<td>0.08</td>
<td>7</td>
<td>0.8</td>
<td>19</td>
<td>9</td>
<td>&lt;0.35</td>
<td>&lt;0.35</td>
<td>Kalan</td>
</tr>
</tbody>
</table>

Çalışmada kullanılan çelik çeşitlerine ve kaynak ilave metaline bağlı olarak kaynak sonrası oluşabilecek yapıyı tahmin edebilmek için Scheaffler diyagramından yararlanılmıştır. Şekil 1'de kaynak sonrası oluşması beklenen kaynak metalik mikroyapısı Schaaffler bilgisayar programı kullanılarak belirlenmiştir. Diyagram üzerinde Armox 500T ana malzeme 1 rakamı, AISI 304 ana malzeme 2 rakamı ve ilave tel C harfi ile belirtilmiştir. Kaynaklı birleştirmede farklı cins çeliğin ergime karışım oranı %50 ve kaynak ilave metal ve ana malzeme ergime karışım oranı %30 olduğu varsayılırak kaynak bileşimi noktası yıldız işaretli ile gösterilmiştir. Programı sonucu kaynak metalik tahlimi kimyasal bileşimi ve Cr, Ni eşdeğerleri her iki birleştirme grubu için ayrı ayrı Çizelge 2 a ve b'de gösterilmiştir.

2. Materyal ve Metot
Determination of the Mechanical Properties of Gas Metal Arc Welded Armox Steels, Kacar vd.

Şekil 1. Birleştirmelerin Scheffler diyagramı, a) Armox 500T-Armox500T, b) Armox 500T-AISI304

Çizelge 2. Kaynak metali tahmini kimyasal bileşimi ve Cr, Ni eşdeğerleri a) Armox 500T-Armox 500T, b) Armox 500T-AISI304

<table>
<thead>
<tr>
<th>Weld Metal</th>
<th>%C</th>
<th>%Si</th>
<th>%Mn</th>
<th>%Cr</th>
<th>%Ni</th>
<th>%Mo</th>
<th>%Nb</th>
<th>%Cu</th>
<th>ppm N</th>
</tr>
</thead>
<tbody>
<tr>
<td>500T-Armox500T</td>
<td>0.131</td>
<td>0.64</td>
<td>4.91</td>
<td>13.13</td>
<td>5.60</td>
<td>0.27</td>
<td>---</td>
<td>0.01</td>
<td>349</td>
</tr>
<tr>
<td>500T-AISI304</td>
<td>0.103</td>
<td>0.70</td>
<td>5.00</td>
<td>17.57</td>
<td>6.95</td>
<td>0.24</td>
<td>---</td>
<td>0.01</td>
<td>650</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
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<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>a)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>b)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Şekil 1 a’daki diyagrama göre; Armox 500T birleştirmelerinin kaynak metali mikroyapısının östenit ve martenzit fazından oluşması beklenmektedir. Şekil 1 b’deki diayagram ise Armox 500T-AISI 304 birleştirmelerinin kaynak metali mikroyapısının ise tamamen östenit fazından oluşacağını işaret etmektedir. Çizelge 2’deki verilere göre kullanılan ilave tel kimyasal kompozisyonuna bağlı olarak kaynak metali kimyasal bileşiminin seyrelerek değişim göstermesi beklenmektedir.

2.2 Malzemelerin Kaynak İşlemi


Birleştirmeler göze yapılan incelemelerde yüzeysel çatlak tespit edilmemiştir. Kaynaklı bağlantı her iki yüzeyinden 0,5 mm taşlama ve ardından zımparalama yapılarak 3,5 mm kesit kalınlığına düşürülmüştür.

Şekil 2. Kaynaklı birleştirme görüntüleri

2.3 Çekme ve Eğme Deneyi

TS EN ISO 6892-1 standardına uygun hazırlanmış ana malzeme ve TS EN ISO 4136 standardına uygun hazırlanmış kaynakli çekme deney numunelerinin çekme testi 50 kN kapasiteli SHIMADZU marka test cihazında 3 mm/dakika çekme hızında gerçekleştirmiştir. Kaynakli birleştirmelerin şekillendirilebilirliğini belirlemek için TS EN ISO 5173 standartında uygun üç nokta eğme numuneleri
2.4 Mikroyapı incelemesi ve sertlik ölçümü


3. Bulgular

3.1 Çekme Deney Sonuçları

GMAK yöntemi birleştirilmiş deney numunelerinin çekme testi sonuçları ve gerilim-uzama eğrileri Çizelge 3'de verilmiştir.

<table>
<thead>
<tr>
<th>Numune</th>
<th>Ort. Uzama (%)</th>
<th>Ort. Gerilme (MPa)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Arinox 500T</td>
<td>2.5</td>
<td>756</td>
</tr>
<tr>
<td>Arinox 500T- AISI 304</td>
<td>12.5</td>
<td>700</td>
</tr>
</tbody>
</table>

Çizelge 3’den görüldüğü gibi aynı cins Arinox 500T çelik çifti birleştirilmesi çekme dayanımı, Arinox 500T- AISI304 farklı cins çelik birleştirilmesinden 56 MPa daha yüksek bulunmuştur. Bilindiği üzere birleştirilmelerde aynı cins malzemelerin kaynağındaki uygun ilave metal ve kaynak parametrelerle kaynak yapıldığında bağlantının mukavemetinin en az ana malzeme kadar dayanıklı olması istenir. Farklı cins malzemelerin kaynağında ise bağlantı mukavemeti dayanımı düşük olan malzeme kadar veya düşük olabilir. Bunun için ilave metal seçimi son derece önemlidir. Bu çalışmada sert ve aşınmaya dirençli zırh çelikinin kendi cins ve östenitik paslanmaz çelik birleştirilmesinde daha sünük, şekil alabilen ve yeterli mukavemet sahibi kaynak metali elde edebilmek amacıyla östenitik yapılı ilave metal kullanılmıştır.
Kaynaklı birleştirme mukavemeti, farklı cins malzemelerin kaynağında kaynaklı numunenin maksimum çekme mukavemetinin ana malzemenin çekme mukavemetine oranı olarak tanımlanabilir. Farklı cins malzemelerin kaynağında çekme mukavemeti performansı yaklaşık %50 olarak hesaplanmıştır. Bu düşük çekme performansı sonucun kaynak metalinin yeterli mukavemet, tokluk ve şekillendirilebilirliğe sahip olması amacıyla seçilgen östenitik paslanmaz çelik ilave teli ilişkili olduğu düşünülmektedir. Farklı cins çelik birleştirmesinde ise performans %100 bulunmuştur. Farklı cins malzeme birleştirmesi için bulunan bu çekme mukavemeti performans sonucu uygun kaynak parametreleri ve ilave metal seçiminde kullanılan performansın ana malzemeyle aynı değerleri ulaşılabilmeceğine işaret etmektedir.

**Şekil 5.** Eğme deney numune görüntülerini a) Armox 500T-Armox 500T, b) Armox 500T-AISI 304.

### 3.3 Mikrosertlik Ölçüm Sonuçları


Armodx 500T-AISI 304 birleştirmesi için, en yüksek ITAB sertliğine Armox 500T çelik ergime bandında 460HV,0,5 değerine ulaşmıştır. AISI 304 ve Armox 500T ana metal birleştirmesine ilave metal olarak ER307 östenit karakterli ilave tel kullanılarak dolaşan birleştirmeye kaynak metalinin ağırlıklı östenitik yapısı olduğu için kaynak metalı ortalama sertliği 230HV,0,5 olarak ölçümüştür.

**Şekil 6.** Mikrosertlik ölçüm sonuçları

### 3.4 Mikroyapı İncelemleri

Şekil 7 ve 8’de sırasıyla Armox 500T-Armox 500T ve Armox 500T-AISI 304 çelik çifti birleştirmesi mikroyapılığını göstermektedir. Şekil 7 a ve 8 f’den su verilmiş ve ardından temperleme isıl işlemi görmüş Armodx 500T ana malzeme, temperlenmiş martenzit ve asiküler martenzit fazlarının oluştuğu görülülmektedir. Şekil 7 ve 8 e’den görüldüğü gibi, birleştirmenin Armodx 500 T çelik taraflı ITAB’a da tane irileşmesi ve kaba tanımlı martenzit yapısı gözne çarpmaktadır.

Jena vd. (2008)’de benzer şekilde Armodx zırh çeliklerinin ergitimi kaynaklı birleştirmelerinde ısı girdisine bağlı olarak ITAB’a kaba martenzit yapının meydana geldiğini belirlemiştir. Şekil 7 f’de Armodx 500T ITAB’dan ana malzeme geçiş bölgesi görülmektedir. Martenzit yapısı ana
malzemeye doğru azalarak homojen bir dağılım sergilemektedir. Armox 500T-Armox 500T birleştirmelerinde kaynak metali mikroyapısının kullanılan ilave telin kimyasal bileşimine bağlı olarak östenitik matris içerisinde widmanstaten tip ferritten meydana geldiği görülmektedir (Şekil 7 b-d).

Şekil 8 a’da östenit fazından oluşan AISI 304 mikroyapısı görülmektedir. Ayrıca yapıda haddeleme bağlı deformasyondan kaynaklanan bantlaşma göze çarpmaktadır. Şekil 8 b’de Armox 500T-AISI 304 birleştirmelerin kaynak metalinden AISI 304 paslanmaz çelik tarafına geçiş bölgesi görülmektedir. Kaynak metalinin östenitik matriks içerisinde skeletal tip delta ferritten oluştuğu görülmektedir (Şekil 8 b ve c).

Şekil 8 d ve e’de Armox 500T-AISI 304 birleştirmenin Armox 500T tarafı ITAB mikroyapısının kaba taneli martenzitik yapıda olduğu görülmektedir.

**Şekil 7.** Armox 500T-Armox 500T birleştirme, a) Armox 500T ana malzeme, b,c,d) kaynak metali, e)ITAB, f)ITAB-ana malzeme geçiş
4. Tartışma ve Genel Sonuçlar

Çalışmada aynı cins Armox 500T zırh çeliği çifti ve AISI 304 paslanmaz çelik ile Armox 500 T farklı cins çelik çifti GMAK yöntemiyle birleştirilmiştir. Birleştirme testleri çekme ve üç nokta eğme testleri uygulanmıştır. Kaynaklı bağlantıların mikroyapı değişimi incelenmiş ve sertlik profilı belirlenmiştir. Elde edilen sonuçlar aşağıdaki şekilde özetlenebilir:

Armox 500T-Armox 500T ve Armox 500T- AISI 304 çelik çifti GMAK yöntemiyle başarılı bir şekilde birleştirilmiştir. Kaynak sonrası birleştirme testlerinde herhangi bir yüzeysel çatlak veya sürekli bir sertlik meydana gelmediği belirlenmiştir.

Armox 500T-Armox 500T birleştirme ortalaması 756 MPa ve uzama miktarı %2,5 olarak tespit edilmiştir. Armox 500T-AISI 304 farklı cins çelik çifti ortalaması 700 MPa ve uzama miktarı %12,5 olarak tespit edilmiştir. Birleştirme çelik dayanımı ayni cins çelik bağlantı için Armox 500T çelik ana malzemeden daha yüksek, Armox 500T-AISI 304 farklı cins birleştirme için AISI 304 paslanmaz çelik çelik dayanımına eşit olduğu belirlenmiştir. Armox 500T çelik çifti birleştirme deneylerinde hasarın kaynak metali-ergime sınırından kesit daralması olmadan gevrek bir şekilde meydana gelmiştir. Armox 500T-AISI 304 farklı cins çelik birleştirme için öostenitik paslanmaz çelik tarafından belirgin bir kesit daralmasıyla sünük bir kıramla davranışa meydana gelmiştir.

Armox 500T çelik çifti birleştirme testlerinde üç nokta eğme deney numunelerinde 90° katlama sonucunda kaynak metalinden çatlak oluşumu meydana geldiği belirlenmiştir. Armox 500T-AISI 304 farklı cins çelik çifti için deney numunelerinin 180° katlama sonrası çatlak oluşumunun daha iyi olduğunu göstermektedir.

AISI 304 ve Armox 500T çelik sertlikleri sırasıyla ortalamaya 200HV ve 330 HV olarak tespit edilmiştir. Her iki aynı ve farklı cins çelik birleştirme deneylerinde Armox 500T çelik çeliği tarafı ana malzemeden ITAB’a doğru gidildikçe sertlik artış göz çarpmaktadır. Armox 500T-Armox 500T çelik çifti birleştirme kaynak metali sertliği, Armox 500T-AISI 304 çelik çifti birleştirme deneylerinde 20HV daha yüksektir. Birleştirme testlerinde kullanılan
malzeme kimyasal bileşim farklılıklarının kaynak metali sertliğini etkilediği görülmektedir.


Teşekkür

Bu çalışmada kaynaklı birleştirmelerin gerçekleştirilmesinde desteklerinden dolayı Askaynak firması ve Kaynak mühendisi Eren Sancar’a ve deney numunelerinin işlenmesinde yardımlarından dolayı Kaynak mühendisi Alpaslan Parlak’a teşekkür edilir.

5. Kaynaklar


Katı ve Biyolojik Atıkların Elektrik Enerji Üretimindeki Yeri

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Anahtar kelimeler
Katı Atık; Çöp; Biokütle; Elektrik Enerjisi

Abstract
In recent years, the population of our country has increased significantly. Following this rise, both the shelter and the energy needs of the factories have seen a big rise. In our country where energy requirements are mostly being removed from non-renewable energy sources, to reduce the use of such resources that are not nature-friendly and make us compulsory against foreign countries, the renewable energy resources that we have, which can support a certain degree, are very important in terms of economic and natural health. Energy from solid waste, ie solid wastes, sustainable, reachable, non-existent elements that are harmful to the environment. This energy, obtained from the waste and solid waste, thanks to the advantages that it has, it has increased its importance in our country and this potential continues to increase.

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1. Giriş
Yakın zamanlarda, nüfus yükselmesi, teknolojideki büyük adımlar ve fabrikaşma gibi çeşitli unsurlarla bağlı olarak hem miktar hem de gerek içerik bakımından kentsel katı atıklar hayatımızın önemli parçası haline gelmiştir. Bu durum önemini, başta gelişmiş ülkeler olmak üzere pek çok açıdan hissettirmektedir. Başı katı atıkların biriktilmesi, ayıklanması yerel ve ulusal yönetimlerin karşısında karşı karşıya kaldığı en mühim çevresel problemlerinden biri olarak sürekli olarak süregelenmiştir. Doğada ve insan sağlığıında geri dönüş olmayan zararlar bırakması önemle

çin katı atıkların düzenleni bir şekilde geri kazandırılması veya çeşitli yöntemlerle tekrar değerlendirilmesi gerekir. Toplumların enerji gereksinimleri yükseldikçe bu gereksinimler işığında ortaya kentsel katı atıkların geri değerlendirilmesiyle elektrik enerjisinin çevrilmesine zemin oluşmuştur.

Tüketime yön veren esas etmenler yükselir, küresel ekonomi, teknolojik yenilikler, evlerin daha minimalist bir yapısı bürünmesi ve yaş ortalaması yüksek bir toplum bulunmaktadır.
Bununla birlikte, yükselen ürün sayıları ve servisleri, bahsi geçen ilerletilmiş üretim teknolojileri ve basamaklarıyla üretilen verim kazanımları için coğunlukla bir dengeleyici unsura karşılık gelmektedir. Bu unsurlar ise çevresel baskılarla gittikçe bir artışa sebep olmaktadır. Konaklama, yeme, içme ve aktivite artışları ile karbondioksit emisyon değerleri, ozon tabakasını gittikçe sındırmış ve sürdürülebilir bir yaşamцовu bakımından da varoluşumuz boyunca doğada çok derin etkiler bırakmaktadır. Varabileceğimiz sonuç şu durum ki dünyaya gelen he bir insan tüm bu temel ihtiyaçları karşılayabilmek adına çok büyük miktarda atık üretmektedir.


2. Kentsel Atıklar


3. Biokütle


Fotosentez olayı sonucu depo edilen oksijen bu yöntemle üretim enerjinin temelini oluşturmakta ve güneş enerjisinin yol aldığı adresler Şekil1’de gösterilmştir. Biokütle ile enerji üretiminde esas olan oksijenli solunum yapan bakterilerin bu paket içerisindeki besinleri

Yazar soyadı vd.
sindirmesi sonucu oluşan metan gibi yanıcı gazlara dayanmaktadır. Bu gazlar yakılarak veya çeşitli motorlara verilerek elde edilen hareket enerjisini üzerinden elektrik enerjisi kazanımına imkan verir.

Organik içerik bakımından zengin olan çöplerin bakteriyel operasyonlarla işlenmesi, çevre kirliliğinin önüne geçmesiyle beraber yenilenebilir enerji kazanımına imkan vermesi yönünden oldukça çok değerlidir. Bu enerji kaynağı gelişen ülkelerin yatırım yaptığı başlıca kaynaklardan biri olarak kabul edilmektedir. Dünyada yaklaşık yüzde onluk dilime denk gelen bu kaynağından other yollarla ve aynı zamanda göz ardı edilemeyecek olumsuz yanları olan bu enerji kaynağıın başlıca özellikleri Tablo 2'de yer verilmiştir.

3. Bulgular

Bu çalışmada yaptığımız incelemeler sonucu katı atık enerji dönüşüm tesisleriyile ilgili yapışmalık özellikleri kapsamadan genel özellikleri hakkında önemli detaylar sunulmuştur. Üzerinde ilki belirtilen kısmın yanı küresel atıkların yanı küresel atıkların analizi bakımından büyük önem arz eden bu olduğunu yaşamımızın büyük bir parçası haline gelmiştir.

Tükuten toplumların ürün olarak alıpk düzenlenmiş olan bu çöplerin geri dönümü, yakma ve düzenli depolama teknolojisi başlıkları altında incelenmiştir. Ülkemiz de bu alınmaya bu bakımdan önemli bir parça haline gelmiştir.

Bizim için esas olan son iki işlem giderek kalın olan çöplerin mümkin olabildiğini geri dönümü kazandırılabilmesini sağlamaktır. Ülkemiz bu adımı genelilemlerine ise en başından yani hane içerisinde işleme göre çalışmayı圖片 kazandırılabilmesini sağlamaktır. Ülkemiz ekonomisine çok büyük değer kazandırıracak bu kültür, sonraki değerlendirme basamaklarında değerli kısımlarda yok olmasının da önüne geçebilir.

Ayni zamanda yakma basamakından da arda kalan cüruf içerisinde beliri bir oranda metaller bulunmaktadır. Bu metaller eritilerek yeniden kazanılır.
Düzenli depolama teknolojisinde ise atıkların bir havuzda depolanması ve içerisinde gerçekleşen tepkimeler sonucunda oluşan gazların yakılması sonucu bir enerji elde edilir. Bu gazlar yine benzer şekilde ya buhar türbinlerinin çalıştırılması veya gaz motorlarının çalıştırılması için kullanılır.

Genellikle bu yöntemlerde soru işaretlerine sebebiyet veren nokta gazların oluşturduğu zararlı emisyonlar olmaktadır. Bu noktada ise devreye verimli filtreleme sistemleri girmektedir. Filtre sistemleri o kadar verimli çalışmaktadır ki doğaya zarar verebilecek emisyonlardan söz etmek neredeyse mümkün değildir.


Tüm bu sistemlerin avantajı ortak bir noktasi ise doğanın korunması dışında sistemin çıkışı olan atık ısının ortam ısıtmasına imkan sağlamasıdır.

5. Kaynaklar


Internet kaynaklar

Effect of Change in Mechanical Properties on Machinability 30MNVS5 Steel Cooled in Sand and Air After Hot Forging

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Abstract

In this study, the effect of the microstructure, hardness, and cutting parameters on cutting force and surface roughness in 30MnVS5 steel cooled in different media (sand and air) after hot forging, was examined. For this purpose, steel samples were subjected to a controlled closed die forging followed by cooling in air and sand mediums. The turning tests were carried using coated carbide cutting tool at four different feed rates of 0.04, 0.08, 0.12 and 0.16 mm/dev, at a constant cutting speed of 180 m/min and at a constant depth of cut of 0.6 mm. The Optical microscope images of samples were examined out and their hardness values was evaluated. In the experimental study, the microstructure, the hardness and feed rates of the samples cooled in different environments was seen had a significant effect on the surface roughness and cutting forces.

Keywords

Hot Forging; Microalloyed Steel; Machinability

1. Introduction

Today, with the developing technology, steels have a widespread usage area. In this respect, in the improvement of microstructure and mechanical properties, heat treatment applied to steel is gaining importance increasingly important (Uzkut and Özdemir 2001). Microalloyed steels are widely used in machinery manufacturing industry. In particular, 38MnVS6 steel is preferred in the automotive industry in high-strength structural elements. Parts made of microalloyed steels is used in the automotive industry in crankshaft, piston, connection rod and steering parts (Das and Chattopadhyay 2009).
Microalloyed steels is a group of materials with superior properties such as high strength, high toughness, low ductile-to-brittle transition temperature (Lawrow 2000). The studies on microalloyed steels were conducted especially between 1970 and 1980. Great improvements have been achieved in the mechanical properties of these steels with the addition of strong carbides and nitride forming elements such as Ti, Al, Nb and V. In this process, called microalloying, the total of alloying elements does not exceed 2% in general. Usually, this value is between 0.1 and 0.2% except for manganese. The advantages of these steels are that they have low alloys, have better machinability, are faster to produce, energy efficient and lighter in weight (Bai, Al. 1998 and Li, al. 2001).

In this study, microstructure and mechanical properties were investigated in 30MnVS6 steels after hot forging at appropriate austenizaiton temperature followed by cooling in different mediums. In addition, it is aimed to investigate the effects of the change in microstructure and hardness depending on the cooling speed on the surface roughness and cutting forces in the samples treated with cemented carbide cutting tool.

2. Material ve Metot

In the experimental studies, microalloyed 30MnVS5 steel, were used. The chemical compositions of 30MnVS5 steel is given in Table 1.

<table>
<thead>
<tr>
<th>Materials (microalloyed Steel)</th>
<th>C</th>
<th>Si</th>
<th>Mn</th>
<th>P</th>
<th>S</th>
<th>V</th>
</tr>
</thead>
<tbody>
<tr>
<td>30MnVS5</td>
<td>0.30</td>
<td>0.50</td>
<td>1.46</td>
<td>0.010</td>
<td>0.032</td>
<td>0.087</td>
</tr>
</tbody>
</table>

Before hot forging, samples are supplied with a diameter of 33 mm and a length of 240 mm. Samples other than the as-received sample were heated to 1200 °C of the induction heating system. After annealing, the samples were subjected to the hot forging process with the 1600 tons eccentric press. The temperature values after forging were measured by using infrared laser thermometer. As a result of after hot forging, the diameters of the samples were reduced from 33 mm to 25 mm and the final temperature was measured as 1150±20 °C. After forging, the samples were cooled in the sand and air in a controlled manner. The surfaces of the samples were ground and the oxides and decarburization zones formed after the heat treatment were removed. The samples were grinded sandpaper until removing all roughness on the surfaces. These surfaces were then polished with diamond pastes. Finally, all prepared samples were etched in 3% Nital solution to examine the microstructure under an optical microscope.

The microhardness measurements of the as-received samples and the samples cooled in different mediums after hot forging were made with the Buehler Micromet 5103 brand Hardness Tester. Micro hardness measurements were carried out by applying HV1 (1000 gr.) load. The microhardness values were determined by taking the average of 10 hardness measurements from each sample. Microstructure analysis were performed using a Nikon ECLIPSE L150 optical microscope with X50-X1000 magnification capacity. Grain sizes, percentage of ferrite and pearlite phases of steel specimens were measured at appropriate magnification using a Clemex Vision Lite brand microstructure analysis system.

The turning experiments were carried out by using a coated carbide cutting tool in dry processing conditions. Turning experiments were made on a Johnford TC35 CNC turning center at constant a cutting speed (Vc) of and constant depths of cut (ap) by using four different feed rate (fn). Table 2 given the process parameters for the turning tests.

<table>
<thead>
<tr>
<th>Experiment No.</th>
<th>Materials</th>
<th>Cutting Speed mm/min</th>
<th>Feed Rate mm/rev</th>
<th>Depth of Cut mm</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>30MnVS5</td>
<td>0.04</td>
<td>0.08</td>
<td>0.6</td>
</tr>
<tr>
<td>2</td>
<td>30MnVS5</td>
<td>0.12</td>
<td>0.16</td>
<td></td>
</tr>
</tbody>
</table>

The turning tests were made using a coated carbide cutting tool, produced by Kennametal firm with the geometry of WNGA 080404T01020. The
cutting tool is coated with Al2O3/TiCN-TiN by PVD method. The turning tests were made with a diameter of 25 mm and a length of 30 mm. fc measurements were made out by using a Kistler 9257A dynamometer. Mitutoyo Surftest 211 was used to measure surface roughness (Ra) values. The measurements were done at three points by rotating the samples by 120 degrees.

3. Experimental Results and Discussions

3.1. Microstructure and hardness

The optical microscope image of the as-received is given in Figure 1. As can be seen in Figure 1, the as-received microstructure of 30MnVS5 steels consisted of the ferrite and pearlite phases.

Figure 1. Microstructure of As-recieved steel (F: Ferrite, P: Perlit).

Figure 2 shows the optical microstructure image obtained from steel samples cooled in sand and air after hot forging. As shown in Figure 2 that steel samples cooled in sand or air after hot forging showed ferrite and pearlite structures with different grain sizes (Fig. 2.a, b). The average mean linear intercept grain sizes, ferrite % and pearlite % calculated with the help of microstructure images are given in Table 3.

Since the rate of cooling in air is faster than the rate of cooling in sand, microstructures of air-cooled samples occurred of thinner ferrite and pearlite structures compared to the sand-cooled samples (Table 3). Recrystallization and even grain growth may occur before the austenite-ferrite transformation at low cooling rates such as the one in sand cooling (Jahazi and Eghbali 2001). Therefore, it was observed that pre-eutectoid ferrite had a network distribution on the grain boundaries and that the 30MnVS5 samples showed coarse grains when they were cooled in sand after closed die forging since the sand cooling rate was slower than the air cooling rate. These results are consistent with the results obtained by (Kaynar al. 2013).

Table 3. The results of the ferrite %, perlite % and grain size of the as-received, sand cooled and air cooled 30MnVS5 steel samples.

<table>
<thead>
<tr>
<th>Sample</th>
<th>Ferrite (%)</th>
<th>Pearlite (%)</th>
<th>Ferrite Grain Size (µm)</th>
<th>Pearlite Grain Size (µm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>As-received</td>
<td>38</td>
<td>62</td>
<td>11</td>
<td>20</td>
</tr>
<tr>
<td>Sand</td>
<td>25</td>
<td>75</td>
<td>9</td>
<td>30</td>
</tr>
</tbody>
</table>
The hardness results of the samples cooled in the sand and air after the hot forging with the as-received are given in Fig. 3. As can be seen that the samples cooled in air found to have higher hardness values than those cooled in sand. The cause for this is the change that takes place in the microstructure images due to the different cooling rate (Demir, al. 2011 and Gündüz, al. 2006). For example, air cooled samples showed smaller ferrite and pearlite grain size and slightly higher percentage pearlite which increase the strength of the air cooled samples.

![Figure 3. Hardness test results of samples (HV1)](image)

### 3.1. Cutting forces

Turning tests were made on 30MnV55 microalloyed samples with different microstructure and hardness values which were obtained samples cooled in different environments after hot forging. Three components of the forces on the tool were measured in the turning tests. The effect of the primary cutting force (Fc) component on power consumption in machining operations is much higher than the feed force (Ff) and radial force (Fr). Therefore, the primary cutting force (Fc) was evaluated in this study. The Fc relationship depending on the fn and cooling environment is shown in Fig. 4.

The effects of the mechanical properties and fn on Fc are seen in Fig. 4. Fc were measured for four different fn (0.04, 0.08, 0.12 and 0.16 mm/rev). The Fc was measured as 129.6 N for as-received samples at 0.04 mm/rev fn. For as-received samples, as the feed rate increased up to 0.16 mm/rev, the Fc values increased at the rates of 111.7%. As can be seen from Fig. 4, sand and air cooled samples after hot forging showed higher Fc than the as-received samples. For example, Fc increased by 4.7% for sand cooled samples, 10% for air cooled samples compared with the respectively to those in the as-received samples. These can be explained by the increase in hardness of the sand and air cooled samples after hot forging. For sand and air cooled samples, as the fn increased up to 0.8 mm/rev, the Fc values increased at the rates of 49.9% in average. After this point, increasing the feed rate to 0.12 mm/rev for sand and air cooled samples decreased respectively Fc 3% and 10%.

![Figure 4. The change in the Fc of 30MnV55 steel depending on the fn with the coated carbide tool.](image)

### 3.2. Surface roughness

The effects of the mechanical properties and fn on the Ra of the turning samples are seen in Fig. 5. Three measurements were made on sample and the arithmetic mean of these was accepted as Ra values. As shown in Fig. 5, the Ra was influenced by a significant amount of the fn. At 0.04 mm/rev fn, Ra values was measured as 1.26 μm, 0.97 μm and 0.87 μm for as-received, sand and air samples. Ra values of as-received, sand and air samples were
found to be about 41–45% lower at 0.08 mm/rev fn compared to those in the samples tested at 0.04 mm/rev fn. Ra values of as-received, sand and air samples was decreased to be about 41–45% lower at 0.08 mm/rev fn compared to those in the samples tested at 0.04 mm/rev fn. At 0.08 mm/rev fn, the lowest Ra values was measured as 0.69 µm, 0.57 µm and 0.48 µm for as-received, sand and air samples. After this point, maximum Ra values were reached for all three samples with 0.16 mm / rev fn. In the literature, it is determination that there is an increasing relationship between the fn and Ra value. Depending on the increase in the fn, the increase in Ra values is an expected situation. Reducing the fn progress to improve Ra values is indicated (Lalwani, al. 2008 and Sandvik Coromant, 1994).

![Surface Roughness vs Feed Rate](image)

**Figure 5.** The change in the surface roughness of 30MnVS5 steel depending on the feed rate with the coated carbide tool.

### 4. Conclusions

This study investigated the microstructure and hardness values of 30MnVS5 steel quenched in sand and air after hot forging and turning tests were carried out using coated carbide cutting tool. The results of the experimental study are presented below.

- **Air cooled samples** were found to be consisted of thinner ferrite and pearlite phases compared to that of samples cooled in sand. This is because of air cooling which is faster than sand cooling.

- **The hardness values** of sand cooled samples with ferritic and perlitic structure were lower than those of samples cooled in air due to slow cooling after hot forging.

- **The lowest cutting force** of 0.04 mm / rev feed rate was measured at 129.6 N in the as-received. The highest cutting force of 0.04 feed rate was 142.67 N measured in the air cooled sample after hot forging.

- **For all three samples,** the maximum cutting force was measured at highest feed rate of 0.16 mm / rev.

### 5. References


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ULUSLARARASI MÜHENDİSLİK TEKNOLOJİLERİ ve UYGULAMALI BİLİMLER DERGİSİ

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