ICMSM 2025

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November 7-8 2025

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7-8 Kasım 2025

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5th International Conference on Materials Science and Manufacturing
5th International Conference on Materials Science and Manufacturing (ICMSM 2025), will be held in Turkey during November 7-8, 2025 in online VIRTUAL format.
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*Listed alphabetical order by name

From the President of the Conference,

Greetings to all participants,

It is a great pleasure for me to welcome you to the 5th International Conference on Materials Science and Manufacturing (ICMSM) 2025 Conference.

We hope that this conference will create a friendly occasion for all to share perspectives and research findings from a wide variety of all engineering. We also dearly value possible friendships and partnerships made and insights gained at the conference and hope they will go beyond your participation in the conference, leading to better understanding and appreciation of our profession from an international stance.

With very best wishes,

Prof. Dr. Uğur KÖKLÜ

President of ICMSM 2025

Programme

Program

Friday, November 7, 2025 Time zone in Turkey (UTC+3)	7 Kasım Cuma 2025
Meeting ID: 819 9747 9639 Password: 577729 https://us06web.zoom.us/j/81997479639?pwd=N63hCrSeayQ0UrwRDbvTQO1GJJ5plv.1 Click to connect/bağlanmak için tıklayınız	
Session 1 (10:20-12:00 AM)	**Session Chair: Dr. Mehmet Sahbaz**
10:20-10:40 AM	Fan Shaft Casting Design: Simulation Verification and Trial Casting Evaluation Lemuel N. Apusaga, Earl T. Geraldo, Karen C. Santos, Joey G. Pangilinan, and Key T. Simfroso
10:40-11:00 AM	Chemical Synthesis of CuAlS2 Thin Films for Photovoltaic Application Y. M. Kondawale, S. N. Pusawale, P. S. Maldar, A. M. Kondawale, P.S.Hubale
11:00-11:20 AM	Toz Yataklı Lazer Birleştirme Eklemeli İmalat Yöntemiyle Üretilen Maraging Çeliğine (Ms1) Uygulanan Isıl İşlemlerin Korozyon Üzerindeki Etkisi Senay ÖZGÜR, Gökhan ÖZER, Alptekin KISASÖZ
11:20-11:40 AM	The Seagrass Leaves of Posidonia Oceanica as Reinforcement in Cement Mortar Sandra Juradin, Silvija Mrakovčić, Ivanka Netinger Grubeša and Marija Babić

PROCEEDINGS / BİLDİRİLER

FULL TEXT PRESENTATION / TAM METİN SUNUMLAR

The Seagrass Leaves of Posidonia Oceanica as Reinforcement in Cement Mortar

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Abstract

Seagrass Posidonia oceanica (PO) is an endemic species of the Mediterranean Sea, named after the Greek god of the sea - Poseidon. This seagrass produces significant amounts of biomass, which means it is constantly creating and developing new parts of the plant. As Posidonia oceanica leaves die, they separate from the parent plant. Waves and sea currents then carry them to various parts of the Mediterranean coast, where they accumulate and, depending on environmental conditions and the openness of the coast, appear in the form of sheets or balls. Due to the large amounts of dead fragments of Posidonia oceanica that accumulate on Mediterranean coasts, there is an increasing need to clean beaches, as these natural remains are perceived as a nuisance, especially in tourist-developed areas. In this paper, PO leaves, taken from the Adriatic Sea beach near Split, were used as cement mortar reinforcement. Some of the seaweed leaves were washed with water and dried in the sun, while others were boiled in water after rinsing. The seagrass specimens were ground to a size up to 1 cm (washed and boiled), and a portion of the washed leaves was manually cut to a size of 2 and 3 cm. Five batches of cement mortar were made: a reference mortar and mixes reinforced with PO. Workability in the fresh state was tested on cement mortar specimens, while in the hardened state, density, flexural strength; compressive strength, σ-δ ratio, water absorption and sorptivity were tested. The addition of seagrass fibers to the cement mortar led to a decrease in its mechanical properties, especially in specimens with longer fibers. The incorporation of seaweed fibers increased the overall porosity of the cement mortar in all specimens, which is reflected in higher water absorption. Pre-treatment of fibers by boiling in water led to a smaller reduction in mechanical properties compared to untreated fibers of the same length.

Keywords: seagrass Posidonia oceanica, cement mortar, mechanical and physical properties

1. Introduction

Posidonia oceanica is the most significant member of seagrass family in the Mediterranean Sea. This seagrass is one of the longest-living organisms in the Mediterranean, and this plant can live up to 1000 years. It grows in vast, dense underwater meadows on the sandy seabed down to a depth of roughly 40 meters. This seagrass produces vital living environments for thousands of marine species by forming underwater meadows. Posidonia oceanica meadows are home to 20 to 25% of all species that inhabit the Mediterranean Sea. Its leaves and rhizomes provide a basis for the development of complex microhabitats, and the meadows can host up to several hundred plant and animal species. Also Posidonia oceanica leaves are a rich source of nutritious biochemical components, which makes them nutritious for many marine organisms [1, 2]. After the leaves of Posidonia oceanica fall off, they wither and separate from the mother plant, and are carried by waves and sea currents to various locations along the Mediterranean coast. They appear as leaves (Fig. 1(a)) or balls (Fig. 1(b)), depending on the location, the waves and sea currents [1, 3].

Fig. 1. (a) Posidonia oceanica in the form of leaves, location Split (Croatia); (b) Posidonia oceanica in the form of balls, location Duras (Albania)

As a lignocellulosic, renewable, light and cheap material, it represents a potential source of cellulose fibers suitable for further application. Adding value to this type of organic waste could represent a sustainable solution to the problem of its accumulation on beaches [3, 4]. One possible way to use fibers is to reinforce cementitious matrices. Allègue et al. [4] tested mechanical properties of Posidonia oceanica (PO) fibers reinforced cement. The fibers were extracted from PO balls that were harvested in Monastir bay in Tunisia and were added to the cement mortar in amounts between 5 and 20 vol %. Because reinforced mortars have more ductility, lower density, and higher flexural strength than traditional cementitious materials, the authors concluded that Posidonia fibers can be used as a reinforcing material in cement composites and recommended a volume percentage of 5 to10% fibers as optimal. Benjeddou et al. [5] added PO fibers obtained from PO balls to the cement paste in an amount from 5 to 20% by volume. The results demonstrated that adding PO fibers increased the compressive strength, reaching a maximum of 33.60 MPa at 10% fiber volume. For all mixes, the addition of fibers resulted in a considerable decrease in thermal conductivity and thermal diffusivity. In [6] the addition of PO fibers in cement paste improved the material insulating properties.

The aim of this research was to investigate the possibility of using PO leaves, found in the Croatian part of the Adriatic Sea, as cement mortar reinforcement. Since the fibers had been under the sea for a long time, one part of the fibers did not need to be treated, while the other part of the fibers was boiled in water.

2. Material and Methods

For testing purposes, 5 series of cement mortars were made: referent mortar and specimens reinforced with seagrass PO. All specimens have the same amount of cement, sand and water. Cement CEM II/A-LL 42.5 R, standard sand SNL in accordance with CEN, EN 196-1and tap water were used. The reference mortar (RM) is a standard mortar made in accordance with HRN EN 196-1 [7]. Seagrass PO was found on beaches around Split, where it appeared exclusively in the form of leaves. During collection, no selection was made according to the age or degree of exposure of the leaves to external conditions. Dried leaves that have been left in the sun for a long time are easily broken, while fresher leaves are somewhat tougher. After collection, the leaves were thoroughly washed in water and then dried naturally in the sun. The final appearance of such fibers is shown in Fig. 2 (a). The washed leaves were divided into 3 groups: one was ground to a size up to 1 cm, the second and third were manually cut to a size of 2 cm and 3 cm. Samples with only washed leaves are marked W. For one test mixture, a portion of the leaves was additionally boiled in hot water for an hour, after which it was dried again in the sun, and then they was ground to a size up to 1 cm. Mortar containing boiled leaves are marked with B. The chopped fibers are shown in Fig. 2 (b).

Fig. 2. (a) PO leaves; (b) chopped PO fibers

The composition and designations of the mortars are given in Table 1.

Table 1 The composition of the mortars, quantity for one mixing

Mortar	Cement (g)	Sand (g)	Water (g)	PO (g)	PO length (cm)
RM				-	-
POW-1				11	≤ 1
POB-1	450	1350	225	11	≤ 1
POW-2				11	2
POW-3				11	3

The fibers were added when the plain mortar was prepared and were mixed manually until complete homogenization. After workability testing according to HRN EN 1015-3 [8], the mortar was casted in a standard three-part mold on a vibrating table. The specimens were placed in a humid chamber, demolded 24 hours after casting, and placed in a water tank at a temperature of 20 ± 2 °C for another 27 days. The mortar properties were tested on six standard prisms (40 mm x 40 mm x 160 mm): three for flexural strength, compressive strength, σ-δ ratio and three for density, sorptivity and water absorption. The sorptivity test (capillary water absorption) was carried out according to the ASTM C1585 [9,10]. Only less than 5 mm of the mortar prisms were submerged in the water. By weighing the prisms, the amount of absorbed water was calculated at various points in time, including 0, 2, 4, 8, 15, 30, 45, 60, 240 and 1440 minutes. Sorptivity coefficient is calculated from expressions (1):

$$S = \frac{M_t - M_0}{A \cdot \sqrt{t}} \tag{1}$$

where M_t is weight of mortar specimen after 1440 minutes, M_0 is initial mass of the dried specimen, A is a cross-section of mortar prism (40 mm x 160 mm) and t is total time of 1440 minutes.

The water absorption (WA) was calculated as:

$$WA = \frac{M_2 - M_1}{M_1} \tag{2}$$

where M_2 is weight of saturated surface dry mortar prism and M_1 is weight of oven dried mortar specimens.

All tests in the hardened state were performed on 3 mortar specimens and the average value and standard deviation are presented in this paper.

3. Results and Discussion

The test results are given in Table 2. Fig. 3 shows the workability measurement on all specimens. According to Table 2, the highest workability of fresh mortar is achieved by the reference mixture.

Table 2 The test results

Mortar	Workability (mm)	Density (g/cm^3)	Flexural strength (MPa)	Compressive strength (MPa)	Saturated water absorption (%)	Sorptivity coefficient (mm/min$^{0.5}$)
RM	220	2.258±0.03	9.04±0.9	49.03±1.4	8.39±0.04	7.52 x10^{-5}
POW-1	163	2.146±0.04	7.17±0.4	32.92±2.8	8.60±0.03	7.45 x10^{-5}
POB-1	155	2.170±0.00	6.88±0.4	36.32±1.4	8.61±0.02	6.67 x10^{-5}
POW-2	163	2.167±0.01	4.85±0.0	16.94±1.0	8.75±0.07	7.45 x10^{-5}
POW-3	150	2.165±0.02	4.08±0.1	16.91±1.6	8.88±0.10	10.25 x10^{-5}

Fig. 4 shows the relative values in relation to the reference mortar. All reinforced mortars had lower workability then RM from 25.9 to 31.8 %. The mixture with the longest fibers has the lowest workability.

Fig. 3. Testing workability on specimens: RM, POW-1, POB-1, POW-2 and POW-3

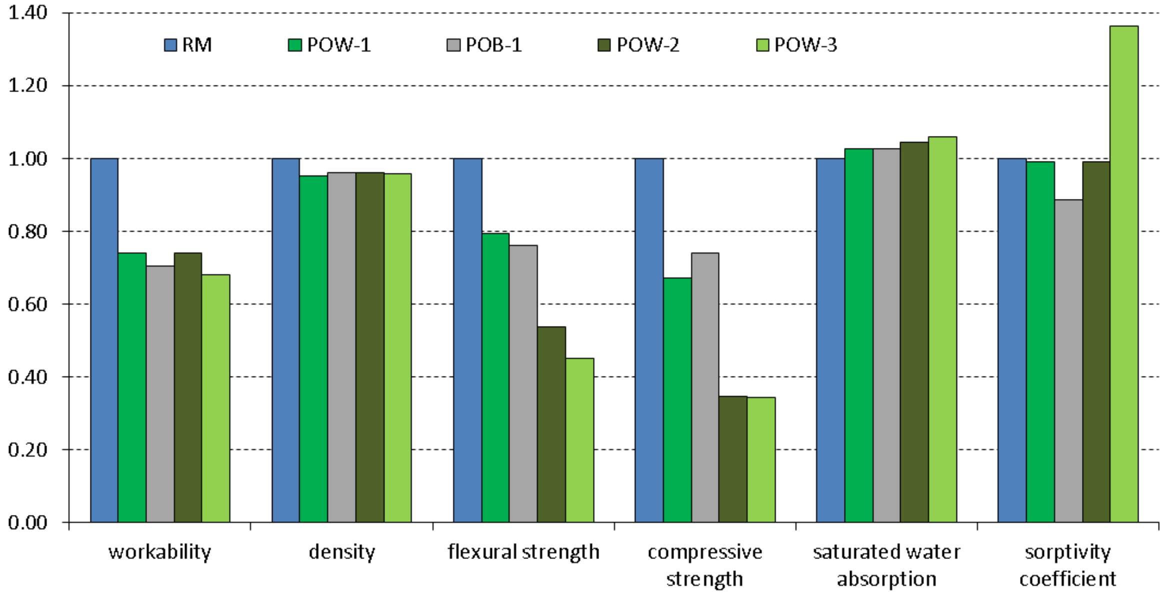

Fig. 4. Relative values compared to the reference mortar

Also, a difference was observed between specimens POW-1 and POB-1, which have fibers of the same length but different pretreatment. Specimen POB-1, which contained boiled fibers, showed lower workability. Two possible causes are: that boiling increased fiber absorption or that the fibers were "softer" after boiling and therefore more finely ground, as is evident from Fig. 5.

Fig. 4. (a) Fibers POW-1; (b) fibers POB-1

The addition of fibers in the specimens reduced the density by 4 to 5% compared to the reference mixture, Table 2 and Fig. 4. The differences in the obtained values of individual specimens are small and it cannot be concluded that the length and treatment of fibers affect the density of the mortar. Benjeddou et al. [5] obtained a density reduction of up to 10%, but there were also higher proportions of PO fibers (0 to 20%). Allègue et. al. [4] determined that the composite containing PO fiber exhibited a lower density compared to traditional cementitious materials.

Considering the test results, it is evident that the reinforcement of cement mortar with PO fibers reduces its flexural strength and compressive strength. The intensity of this reduction depends on the properties of the fibers, i.e. their length and treatment method, and ranges from 20.7 to 54.9% for flexural strength and from 25.9 to 65.5% for compressive strength. Specimens POW-1 and POB-1, which contain shorter fibers up to 10 mm in length, showed a smaller decrease in flexural and compressive strength compared to specimens with longer fibers. Specimen POW-3, which contains fibers 3 cm in length, recorded a decrease in flexural strength of more than 54.9% compared to RM, while specimen POW-2 has a slightly lower reduction, 46.4 %. In the compressive strength results, the largest decrease was recorded in sample POW-3 with the longest fibers, where the compressive strength was reduced by 65.5% compared to RM, and specimen POW-2, although it has slightly shorter fibers, showed almost the same result (65.4%). Fig. 5 shows the cross section of the specimens POW-2 and POW-3 after flexural strength testing. In specimens with longer fibers, trapped air pockets were observed that failed to escape from the mixture during compaction. These bubbles were most often located under the fibers, which indicate that the fibers trapped some of the air inside the mortar during mixing and compaction. It is likely that the air, trying to escape to the surface during compaction, encountered a physical obstacle in the form of seagrass fibers that, due to their structure, are not breathable and acted as a barrier. Fig. 6 illustrates examples of various fibers that exhibit a dense structure, with some even being overrun by other organisms. Juradin et al. [11] investigated the use of textile waste, specifically cotton waste strips measuring 2 x 0.5 to 1 cm, as reinforcement in cement screed. A significant improvement in the ductility of the material was noted, with a possible decrease in mechanical properties, but within acceptable limits. The better performance of cotton fibers, although they correspond in surface area to 2 cm long seagrass fibers, can be partly explained by the fact that cotton fibers are significantly more breathable, which prevents the formation of larger air bubbles under the fibers, which was observed in this study. These air pockets contribute to the deterioration of mechanical properties and disrupt the contact zone between the fibers and the mortar. In Fig 7 (a) POW-1 specimens are shown, which have a significantly smaller number and diameter of voids in the cross-section.

Fig. 5. (a) Cross section of POW-2; (b) Cross section of POW-3

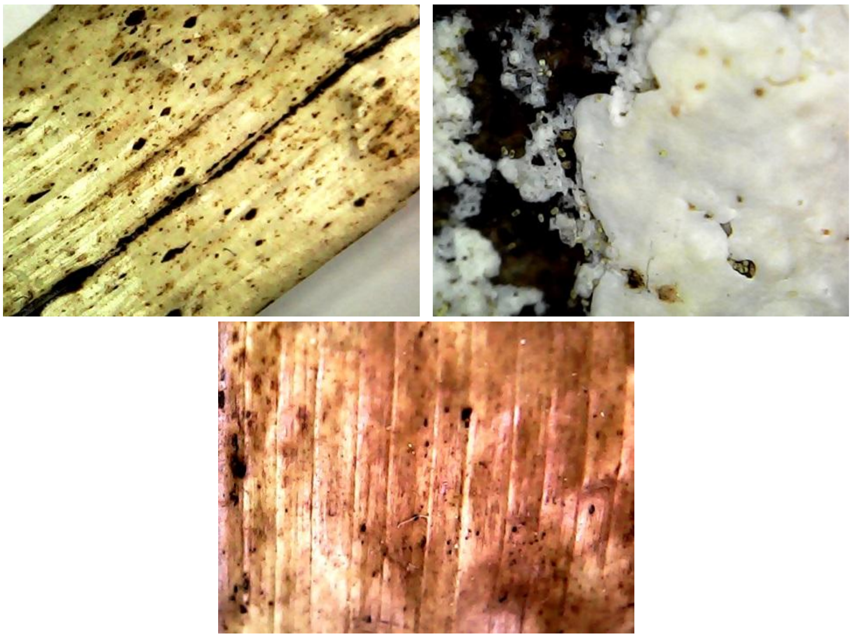

Fig. 6. PO leaves

The σ-δ diagrams of all test mixtures are shown in Fig. 7 (b). From the shape of the curves, it is evident that the specimens exhibit brittle behavior in response to loading, characterized by a steep increase in stress to peak strength, followed by an almost instantaneous break in the diagram. Such behavior, which results in brittle, or abrupt, fracture, confirms that the presence of PO fibers, regardless of the treatment, did not contribute to an increase in the ductility of the material.

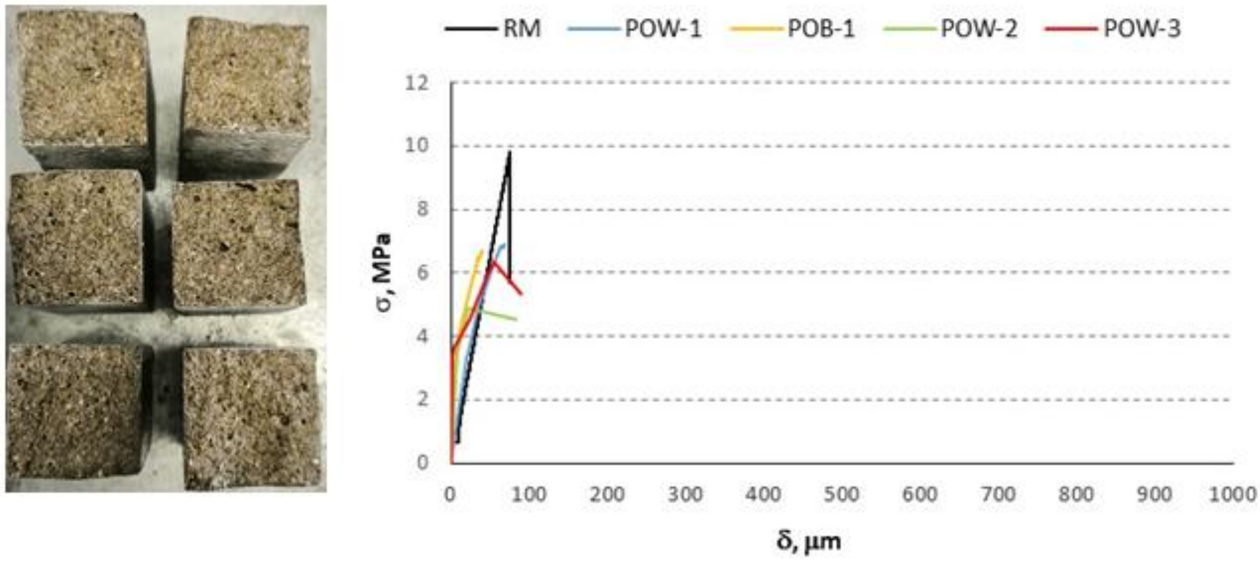

Fig. 7. (a) POW-1 specimens after testing; (b) σ - δ diagram

Based on the results in Table 2 and Fig. 4, an increase in absorption is observed by introducing seagrass fibers into the cement mortar. The type of pretreatment in this case did not have a significant effect on absorption. On the other hand, the length of the fibers, as a parameter, had an effect on the increase. The highest absorption value was shown by the POW-3 sample, which contained the longest fibers, with a recorded increase of 5.8% compared to the referent mortar.

Specimen POB-1 has the lowest sorptivity coefficient, which indicates improved resistance of the mortar reinforced with short and treated fibers to capillary absorption compared to the unreinforce specimen. On the other hand, specimen POW-3 records the highest coefficient, which is 36.3% higher than the reference mortar. The values for specimens POW-1 and POW-2 are slightly lower than the RM. Fig. 8 shows the values of capillary absorption as a function of time.

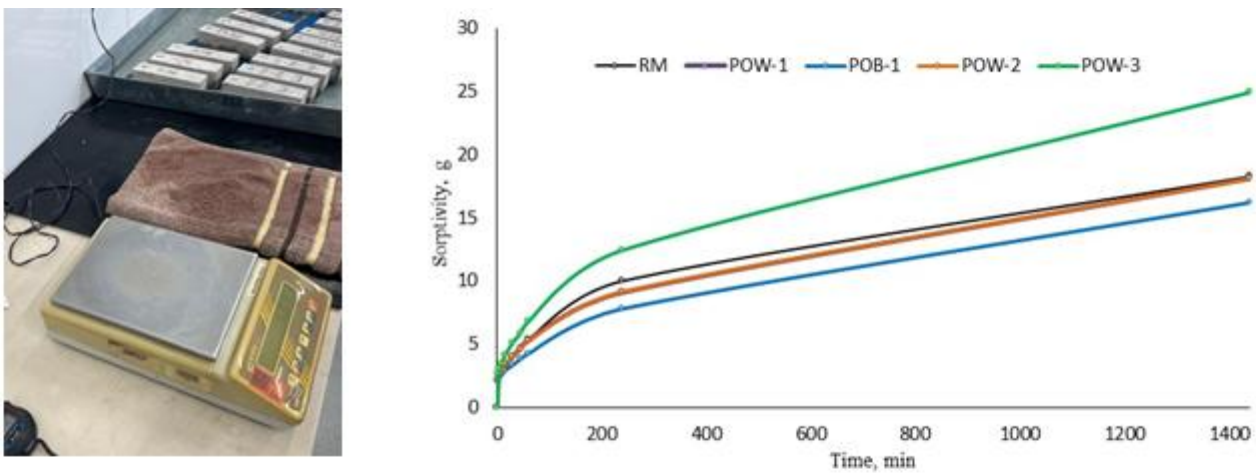

Fig. 8. (a) Test set up; (b) Sorptivity (g) versus time (minute)

The highest increase in sorptivity (g) was recorded for specimen POW-3, which is consistent with the results in Table 2 for sorptivity coefficient and water absorption. On the other hand, the lowest amount of water absorbed in 24 hours was for specimen POB-1 with fibers boiled in water. The results for specimens POW-1 and POW-2 are very similar, so their curves almost overlap. Although these curves are below the RM value, after 24 hours they fall to almost the same point.

4. Conclusion

In order to test the possibility of reinforcing cement mortar with PO leaves collected from the Adriatic coast, four mortar mixtures reinforced with fibers of different lengths and pretreatments were prepared, in an amount of 1% by volume, and a reference unreinforced mortar. Based on the results obtained, it can be concluded:

- The workability of all reinforced mixtures was reduced by the introduction of seagrass fibers compared to the reference mortar. The greatest reduction was recorded in the specimen with the longest fibers, and for fibers of the same length, better results were achieved by boiled fibers.
- The fibers significantly reduced the mechanical properties of the mortar, and in specimens with longer fiber lengths, larger air pockets formed under their surface.
- No contribution to increasing ductility was observed.
- The addition of PO fibers resulted in a slight decrease in density.
- The introduction of seagrass fibers increased the total porosity of the cement mortar in all specimens, which is manifested by higher water absorption. In this case, the pre-treatment of the fibers did not have a significant effect on porosity, but in the capillary water absorption test it showed a positive effect, because the specimen with shorter and treated fibers recorded a lower sorptivity coefficient compared to the reference mixture.

Given the limited number of studies on this subject and the discrepancies between the findings of this study and prior research (which primarily utilized fibers from seagrass balls), it is evident that knowledge about the use of seagrass fibers in their current form as reinforcement in cement matrices remains insufficient. This underlines the necessity for further research, exploring these fibers in alternative applications or as micro-reinforcements, with various treatments, lengths, and shapes being considered.

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ABSTRACT PRESANTATION/ ÖZET SUNUMLAR

TOZ YATAKLI LAZER BİRLEŞTİRME EKLEMELİ İMALAT YÖNTEMİYLE ÜRETİLEN MARAGİNG ÇELİĞİNE (MS1) UYGULANAN ISIL İŞLEMLERİN KOROZYON ÜZERİNDEKİ ETKİSİ

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Özet

Toz Yataklı Lazer Birleştirme (PBLF) Eklemeli İmalat (Eİ) üretim tekniği, geleneksel yöntemlere kıyasla malzemelerin mekanik özelliklerini artırarak katman katman özel tasarım bileşenler üretir. Özellikle, maraging çeliği yüksek kaynaklanabilirliği, düşük yansıtıcılığı ve soğutulduğunda termal çatlamayı önleyen düşük karbon içeriği nedeniyle genellikle lazer toz yatağı füzyon katkı imalat teknikleri kullanılarak üretilir. Ek olarak, eklemeli imalat yoluyla üretimden sonra maraging çeliklerinde hem toklukta hem de mukavemette önemli bir artışı doğrulayan çalışmalar bulunmaktadır. Bu özelliklerinden dolayı sıklıkla enjeksiyon kalıplama, kesme aletleri, havacılık, savunma ve ağır makine alanlarında MS1 çeliği tercih edilmektedir. Ancak, eklemeli imalat süreçlerinden kaynaklanan süneklik ve gerinim sertleşmesindeki azalma nedeniyle maraging çeliklerinin ticari uygulanabilirliği düşmektedir. Araştırmalar, Eİ/MS1 çeliklerinde gelişmiş mekanik performansın martenzitin östenite dönüşümü yoluyla elde edilebileceğini göstermektedir. Bununla birlikte, literatürde α'-γ' dönüşümünün eklemeli imalatla üretilen maraging çeliklerinin mikro yapısının korozyon özellikleri üzerindeki etkilerini anlamayı amaçlayan sınırlı sayıda etkili çalışma bulunmaktadır.

Bu çalışmada, bir Toz Yataklı Lazer Birleştirme teknolojisi olan Doğrudan Metal Lazer Sinterleme (DMLS) tekniğiyle üretilen ısıl işlem görmüş maraging çeliğinin (MS1) korozyon davranışını incelemektedir. Çalışmada, maraging çeliğinin dayanım, sertlik ve korozyon özelliklerini iyileştirmek amacıyla, klasik çözeltiye alma ve yaşlandırma ısıl işlemlerinin ara adımında interkritik tavlama işlemi uygulanmıştır. İnterkritik tavlama sıcaklık aralığı, çökelmenin gerçekleşmeyeceği bir sıcaklık aralığında yer alması gerektiği için çeliğin östenit başlangıç ve bitiş sıcaklıkları arasında yer alan sıcaklıklar seçilmiştir. Bu doğrultuda, 690 ve 720°C'de 5 dakika boyunca iki farklı sıcaklıkta interkritik tavlama ısıl işlemi çözeltiye alma ve yaşlandırmanın ara basamağında uygulanmıştır. Böylece, martenzitten östenitin geri dönüşümü sağlanarak östenitin hacim fraksiyonunun arttırılması hedeflenmektedir. Isıl işlemlerin uygulanmasının ardından MS1'in mikro yapısı, faz dönüşümleri ve korozyon özellikleri üzerindeki ısıl işlemlerin etkilerini tanımlamak için elde edilen sonuçlar, üretildiği durumla karşılaştırılmıştır. Sonuçlar, diğer numunelerle karşılaştırıldığında, interkritik tavlanan numunelerde östenit fazının geri dönüşümünün görece yüksek miktarda gerçekleştiğini göstermektedir. Ek olarak, interkritik ısıl işlemin sıcaklığı değiştiğinde, geri dönen östenitin martenzit lamellerinin sınırları yakınında farklı morfolojilerde çökeldiğini göstermektedir. Buna göre, interkritik ısıl işlem süreci MS1 malzemenin mikro yapısını ve korozyon özelliklerini iyileştirir. Çalışmada, interkritik ısıl işleme tabi tutulan numunelerin

mikroyapısında östenit geri dönüşümüne bağlı olarak sertlik değerlerinde artış tespit edilmiştir. Ayrıca, bu numunelerin yeni basılmış, yaşlandırılmış ve homojenleştirilmiş numunelere kıyasla daha düşük korozyon akım yoğunluğu ve korozyon hızı gösterirken, aynı zamanda yüksek korozyon direnci gösterdiği ortaya konmuştur.
Anahtar kelimeler: Eklemeli İmalat (Eİ), Maraging Çeliği, Doğrudan Metal Lazer Sinterleme (DMLS), İnterkritik Isıl İşlem, Korozyon Davranışı

CHEMICAL SYNTHESIS OF CUALS2 THIN FILMS FOR PHOTOVOLTAIC APPLICATION

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Abstract

In the developing world, where growth is a priority, there is a need for safe, low-cost, easily available materials for solar cells. This is very important in renewable energy research. Copper aluminum sulfide ($CuAlS_2$) is a good choice because it has a wide band gap can absorb light in a significant amount. This study shows that the thin glass substrates are being coated with the $CuAlS_2$ material by repeating 100 cycles with the method of Successive Ionic Layered Adsorption and Reaction (SILAR). To enhance the different physicochemical properties of deposited films, the films are being heated with sulfur powder at a temperature of 200 ^{o}C. To investigate their structural, morphological, compositional analysis, the films were characterized through X-ray diffraction (XRD). Scanning electron microscopy (SEM) coupled with energy dispersive X-ray analysis (EDS). X-ray diffraction revealed a tetragonal structure of the films. Surface morphology revealed non-uniform morphology with the surface comprising of elongated grains. EDS revealed the films are composed with constituent elements Cu, Al, and S. The SILAR-coated $CuAlS_2$ thin films are possible prominent candidates for fabrication of low-cost thin film solar cells.

Keywords: $CuAlS_2$; SILAR; thin films; X-ray diffraction; tetragonal structure; elongated grains.

Fan Shaft Casting Design: Simulation Verification and Trial Casting Evaluation

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Abstract

A fan shaft casting design intended for high-temperature service was developed and evaluated through simulation and trial casting. Initial casting simulations using NovaFlow&Solid were conducted to identify an optimal gating and riser design for the green sand-casting process. The resulting design parameters were then applied to a no-bake molding system, where the fan shaft was cast using SCH 15 stainless steel at pouring temperatures of 1564°C, 1578°C, and 1591°C. The cast fan shaft was assessed through visual and dimensional inspections, followed by sectioning to evaluate internal soundness. The casting trial results showed acceptable internal defects, with most sections free from shrinkage cavities and exhibiting only minimal surface depressions. The observed deviation between the simulated and experimental casting results arises from the software's limited material database, which lacked the specific alloy employed in the actual casting trials. However, the final casting output demonstrated fair agreement with the simulation results which confirms the effectiveness of the molding system and the adequacy of the developed casting design for producing a sound fan shaft component.

Keywords: casting design; fan shaft; no-bake molding system; sand casting

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