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Hydrophobic Coating on Metal Matrix Composites

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Abstract: The combination of traditional aluminum metal matrix composites (MMCs) with innovative reinforcement materials offers promising avenues for enhancing material properties and expanding application domains. In this study, aluminum matrix composites reinforced with ZrB2 (zirconium diboride) particles were fabricated using a stir casting technique. The addition of ZrB2 to the aluminum matrix aimed to improve mechanical strength, wear resistance, and thermal stability. Following fabrication, the resulting composite specimens were subjected to a surface modification process involving the application of a superhydrophobic coating.

The superhydrophobic coating, characterized by its extreme water repellency and self-cleaning properties, was applied to the surface of the aluminum-ZrB2 composites using a spray-coating method. The coating material consisted of a hydrophobic compound integrated with nanostructured particles, engineered to achieve a hierarchical surface morphology that mimics natural superhydrophobic surfaces. The coated specimens were evaluated for their water repellency, contact angle measurements, and durability under various environmental conditions.

The results of this study demonstrated that the combination of aluminum metal matrix composites with ZrB2 reinforcement, coupled with the application of a superhydrophobic coating, yielded surfaces with exceptional water-repellent properties. The coated composites exhibited high contact angles and low water adhesion, indicative of their superhydrophobic nature. Furthermore, the durability tests revealed the robustness of the coating against mechanical abrasion and environmental exposure.

Overall, the integration of aluminum-ZrB2 composites with a superhydrophobic coating holds significant promise for applications requiring water-resistant surfaces, suchas aerospace components, marine structures, and outdoor equipment. This researchcontributes to advancing the development of multifunctional materials with tailoredsurface properties, paving the way for improved performance and longevity in diverse engineering applications

Keywords: Aluminum Metal Matrix Composites, Zirconium Diboride, Superhydrophobic Coating.

I. INTRODUCTION

A. 3 Series Aluminum Metal Matrix Composites

Aluminum Metal Matrix Composites (Al-MMCs) belonging to the 3 Series of aluminum alloys represent a significant advancement in material science and engineering. These composites are engineered materials comprising a matrix of aluminum alloy reinforced with particles of other materials, often ceramics or carbon-based substances. The incorporation of these reinforcements enhances the mechanical, thermal, and tribological properties of the resulting composite material.

The fabrication process of 3 Series Al-MMCs typically involves several steps. One common method is stir casting, where the aluminum alloy matrix is melted and mixed with the reinforcement particles in a crucible. Stirring is then employed to ensure uniform dispersion of the particles throughout the molten matrix. This method is favored for its simplicity, cost-effectiveness, and ability to accommodate a wide range of reinforcement materials.

Another fabrication method is powder metallurgy, where the aluminum alloy and reinforcement particles are blended together in powder form before being compacted into the desired shape under high pressure. The compacted material is then sintered at elevated temperatures to bond the particles and consolidate the composite structure.

In-situ synthesis is another approach where the reinforcement phase is formed within the aluminum matrix during the fabrication process. This method involves introducing precursor materials that react to form the desired reinforcement phase in situ, resulting in a homogeneous composite material.

The choice of reinforcement materials depends on the specific requirements of the application. Common reinforcements include silicon carbide (SiC), alumina (Al2O3), boron carbide (B4C), and carbon nanotubes (CNTs). Each reinforcement offers unique properties, such as high strength, stiffness, wear resistance, or thermal conductivity, which can be tailored to meet the demands of various industries and applications.

3 Series Al-MMCs find widespread applications across industries such as aerospace, automotive, marine, and sporting goods.

In aerospace, these composites are used to manufacture lightweight yet durable components for aircraft and spacecraft, contributing to fuel efficiency and performance. In the automotive sector, Al-MMCs are employed in engine components, suspension systems, and structural parts to improve fuel economy, reduce emissions, and enhance safety.
The continuous development of fabrication techniques and the exploration of new reinforcement materials continue to drive innovation in the field of Aluminum Metal Matrix Composites. With their superior properties and versatility, Al-MMCs are poised to play a crucial role in the advancement of modern engineering and manufacturing.

B. Zirconium diboride (ZrB2)

Stands out as a highly covalent refractory ceramic material characterized by a hexagonal crystal structure. This unique compound boasts an impressive melting point of 3246 °C, making it an exemplary ultra-high temperature ceramic With a relatively low density of approximately 6.09 g/cm3 (though measured density may elevate due to hafnium impurities), coupled with commendable high temperature strength, ZrB2 emerges as a prime candidate for demanding aerospace applications like hypersonic flight or rocket propulsion systems.
It's noteworthy that ZrB2 showcases exceptional thermal and electrical conductivities, a trait it shares with isostructural counterparts such as titanium diboride and hafnium diboride.Typically, ZrB2 parts undergo hot pressing, where pressure is applied to heated powder followed by machining to achieve the desired shape.
However, sintering of ZrB2 encounters hurdles due to its covalent nature and the presence of surface oxides, which tend to increase grain coarsening prior to densification during the sintering process. While pressureless sintering of ZrB2 is feasible with the addition of sintering aids like boron carbide and carbon, which react with surface oxides to enhance sintering, this method may lead to a degradation in mechanical properties compared to hot pressed ZrB2.To enhance oxidation resistance, ZrB2 often incorporates approximately 30 vol% silicon carbide (SiC). This addition facilitates the formation of a protective oxide layer through SiC, akin to aluminum's protective alumina layer.
ZrB2 finds widespread application in ultra-high temperature ceramic matrix composites .In composite materials, carbon fiber-reinforced zirconium diboride composites exhibit remarkable toughness. Conversely, silicon carbide fiber-reinforced zirconium diboride composites tend to be brittle and susceptible to catastrophic failure.

C. Metal Matrix Composites (MMCS)

Metal matrix composites (MMCs) incorporating Zirconium Diboride (ZrB2) represent a significant advancement in material science, offering a unique combination of properties that make them highly desirable for a wide range of applications. ZrB2, characterized by its remarkable hardness, high melting point, and excellent thermal conductivity, serves as an ideal reinforcement material in MMCs. The incorporation of ZrB2 into the metal matrix leads to the formation of a robust composite structure with enhanced mechanical properties, including increased tensile strength, improved hardness, and enhanced fracture toughness. Moreover, the dispersion of ZrB2 particles within the metal matrix contributes to improved wear resistance, making MMCs suitable for applications where abrasion and erosion are prevalent.Fabrication methods such as powder metallurgy, liquid metal infiltration, and chemical vapor deposition enable precise control over the distribution and orientation of ZrB2 particles within the metal matrix, allowing for the optimization of microstructural characteristics.
This fine-tuning of the microstructure further enhances the mechanical properties and thermal stability of MMCs with ZrB2 reinforcement. Additionally, thecompatibility of ZrB2 with various metal matrices enables the customization of MMCs tailored to specific application requirements.One of the most significant advantages of MMCs with ZrB2 reinforcement is their exceptional high-temperature performance. The inherent thermal stability of ZrB2 combined with the heat dissipation properties of the metal matrix makes these composites well-suited for applications in environments with elevated temperatures, such as aerospace propulsion systems and automotive engine components.
Furthermore, MMCs with ZrB2 reinforcement exhibit excellent resistance to thermal shock and oxidation, ensuring reliable performance under extreme conditions.In addition to their mechanical and thermal properties, MMCs with ZrB2 reinforcement also demonstrate good corrosion resistance, particularly in harsh chemical environments. This corrosion resistance extends the service life of components made from these composites, making them suitable for applications in corrosive industrial settings.Overall, the integration of ZrB2 into metal matrix composites offers numerous advantages, including enhanced mechanical properties, improved wear resistance, excellent thermal stability, and corrosion resistance.
These properties make MMCs with ZrB2 reinforcement highly desirable for a wide range of high-performance applications across various industries, from aerospace and automotive to defense and energy.

Continued research and development efforts in this field hold the potential to unlock even more innovative applications and further optimize the properties of these advanced materials.

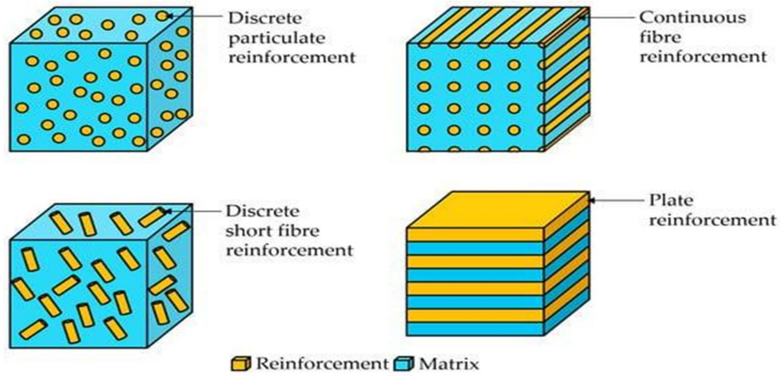


Figure :1 Metal matrix composites (MMC)

II. EXPERIMENTATION

A. Material

The choice of materials in a metal matrix composite, such as Al/ZrB2, is determined by several factors aimed at achieving specific properties and performance characteristics like each material contributes unique mechanical properties such as strength, ductility, and hardness. Aluminum (Al) is lightweight with good strength, while zirconium diboride (ZrB2) offers excellent electrical conductivity and formability. ZrB2 may be chosen for its corrosion resistance or as a sacrificial layer to protect underlying materials.

The feasibility and cost-effectiveness of manufacturing the metal matrix composite also influence material selection. Each material should be compatible with the chosen fabrication method, such as casting, to ensure success ful production.In the case of ZrB2, aluminum provides structural strength, while offer conductivity and corrosion resistance. ZrB2 may serve as a protective barrier or provide additional mechanical properties. The arrangement of materials aims to optimize the performance of the composite for its intended application, considering factors such as mechanical strength, conductivity, corrosion resistance, and manufacturing feasibility.

B. Fabrication

The fabrication of metal matrix composites through the Stir casting process involvesa sophisticated series of steps aimed at achieving precise layering and bonding of materials. Initially, the process commences with the preparation of individual metal of aluminum (Al), zirconium diboride (ZrB2), each with specified thicknesses tailored to the desired composite structure.These metals undergo meticulous surface cleaning and treatment to ensure optimal adhesion and bonding during subsequent processing stages.In this current research, aluminum (Al), zirconium diboride (ZrB2) are utilized in the form of matrials with varying sizes . The fabrication of metal matrix composites is achieved through the Stir casting process. Initially, two metals each of Al, ZrB2, are equal quantity according to specifications. The Stir casting fabrication process unfolds in distinct stages. Firstly, Stir casting procedure is followed since it is an economical method to produce composites of aluminium matrix . AA7178 matrix is dissolved at 850 ◦C temperature in a crucible. At the same time, ZrB2 is maintained at 400 ◦C temperature.

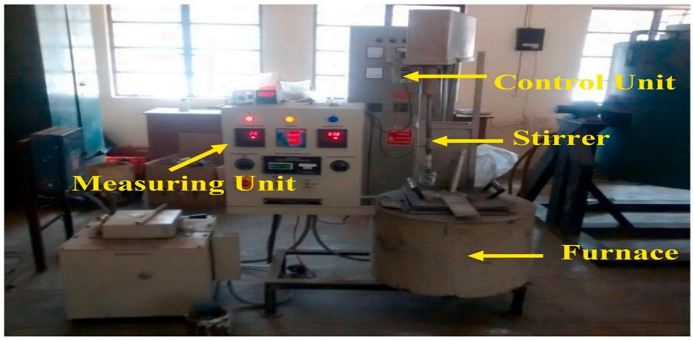


Fig. 2. Stir casting process setup.

Reinforcement is preheated to remove the moisture present in the particles and to make more compatible with molten aluminium alloy in the furnace second, Stirring was done at 500 rpm in 5 min for spreading ZrB2 in the matrix of aluminium alloy. Then molten slurry was dropped into rectangular split die (100 mm × 100 mm × 10 mm) and circular split die (20 mm × 300 mm). These sheets are meticulously cleaned, wirebrushed, and arranged before passing.The final stage involves repeating the process at temperature, culminating in the production of a fully developed metal matrix composite. The microstructure of the composite is meticulously examined using scanning electron microscopy (SEM), while phase analysis is conducted through X-ray diffraction (XRD) with the aid of specialized software. Through this systematic fabrication approach, precise layering and bonding are achieved, resulting in a robust metal matrix composite with tailored material properties optimized for diverse industrial application.

C. Corrosion Experimentation

The corrosion behavior of the metal matrix composite samples processed through various stri casting at temperature. Corrosion parameters such as corrosion potential and current density were extracted from the obtained polarization curves and tabulated for analysis.Observations from the polarization curves revealed that copper exhibited a more positive corrosion potential and lower corrosion rate compared to aluminum and zinc.

It was noted that with an increase in applied strain, the corrosion potential became more negative from the first to the ninth cycle. This trend suggested a decrease in corrosion resistance with increasing cycles. The macro-images of the sample surfaces depicted changes in layer thickness and distribution, with copper initially present on the surface but gradually replaced by aluminum and ZrB2 in subsequent cycles.The presence of aluminum and Zrb2 on the surface led to the formation of galvanic cells, contributing to reduced corrosion resistance.Analysis of corrosion current density indicated a decrease in corrosion resistance with an increase in the number of metal matrix composites. Notably, the composite sample produced after the first cycle exhibited lower corrosion resistance compared to the primary metal matrix, despite similar surface metal matrix composition . This difference was attributed to grain refining and residual strain induced by the metal matirx process, affecting the corrosion behavior at grain boundaries.Corrosion polarization tests were conducted using a 3.5 wt% NaCl aqueous solution at room temperature.Specimens were stabilized in the solution before measurements, with Ag/AgCl, Pt, and the specimens serving as reference electrode, counter electrode, and working electrode, respectively. Corrosion potential (Ecorr) and corrosion current density (Icorr) werecalculated from the intersection of cathodic and anodic Tafel curves.In other Hydrophobiccoated specimen, the Gill AC system was used to study the corrosion behavior of SuperHydrophobic coated metal matrix composites. The system uses potentiodynamic polarization curves to evaluate the composite's resistance. The experiments involved polarization tests in a 3.5 wt% NaCl solution, with a carbon electrode as the auxiliary electrode and a saturated calomel electrode as the reference electrode. The corrosion potential and current density values were calculated based on the intersection of the anodic and cathodic Tafel curves.

D. Superhydrophobic Coating

Super-hydrophobic coatings have garnered significant attention in recent years for their remarkable ability to repel water and other liquids from surfaces, leading to a wide range of applications across various industries. When applied to aluminum alloy surfaces, these coatings offer unique benefits, transforming them into water-repellent, self cleaning, and corrosion-resistant substrates.The process of creating super-hydrophobic coatings on aluminum alloy typically involves modifying the surface morphology and chemistry to achieve water repellency.

One common approach is to utilize nanotechnology, where nanostructures are engineered onto the surface to create a rough texture, coupled with the application of hydrophobic agents to lower the surface energy. This combination results in the formation of air pockets on the surface, minimizing contact between water droplets and the substrate, thus leading to the "lotus effect" observed in nature.These super-hydrophobic coatings exhibit exceptional water repellency, with water droplets forming nearly spherical shapes and easily rolling off the surface, carrying away dirt, dust, and contaminants in the process. This self-cleaning property not only maintains the aesthetic appearance of the aluminum alloy surface but also reduces the need for frequent cleaning and maintenance.Moreover, super-hydrophobic coatings provide excellent corrosion protection to aluminum alloy substrates. By repelling water and preventing moisture ingress, these coatings effectively inhibit the corrosion process, prolonging the service life of the material in harsh environments. This is particularly beneficial in marine, aerospace, and automotive applications, where aluminum alloys are susceptible to corrosion due to exposure to moisture, salt, and other corrosive agents.In addition to water repellency and corrosion resistance, super-hydrophobic coatings on aluminum alloy offer other advantages such as improved icephobicity, enhanced anti-fouling properties, and reduced friction.

These properties find applications in anti-icing coatings for aircraft wings, marine vessels, and wind turbine blades, where the prevention of ice accumulation is critical for safety and performance.Furthermore, the versatility of super-hydrophobic coatings allows for their application on various aluminum alloy substrates, including sheet metal, extrusions, castings, and machined components. This flexibility enables their use in a wide range of industries, including construction, transportation, electronics, and renewable energy.In super-hydrophobic coatings have emerged as a promising technology for enhancing the performance and durability of aluminum alloy surfaces. With their exceptional water repellency, self-cleaning properties, and corrosion resistance, these coatings offer numerous benefits across diverse applications, contributing to the advancement of materials science and engineering. Continued research and development in this field hold the potential for further innovation and expansion of super-hydrophobic coatings on aluminum alloy substrates, opening up new possibilities for improved functionality and sustainability.

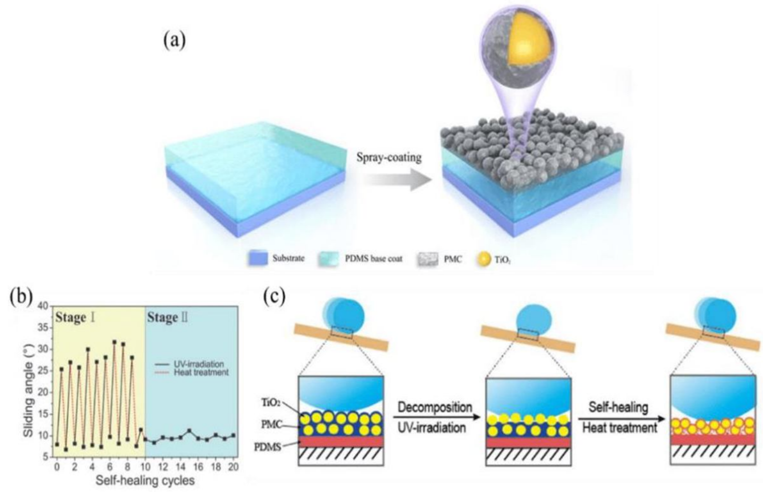


Figure:3 superhydrophobic coating

III. RESULTS AND DISCUSSION

This Section comprises of Results and Discussion that we have come across the evaluation phase. The discussion of the results was segregated under various categories like

A. *Microstructure Structure Analysis*

The roughness of the coatings was in the range of tens of nanometers, and they were generally smooth. Similar surface morphology, with evenly dispersed carbon clusters, was seen in the vacuum-deposited multilayered composite, as shown in Figures a and b. Structural analysis is done by scanning electron microscopy (SEM), and it shows the structure of material following acetone cleaning and alcohol drying. The chemical element is ferric chloride used in the process for microscopic evaluations. The chemical etchant composition is 5 ml of HCL, 5 grams of $FeCl_3$, and 100 ml of methanol. After investing in or observing the microstructure of diamond-like carbon-coated multilayered material, it shows good adhesion between surface and coating. Using the plasma ion immersion technique may help with good adhesion to materials, as shown in figure.

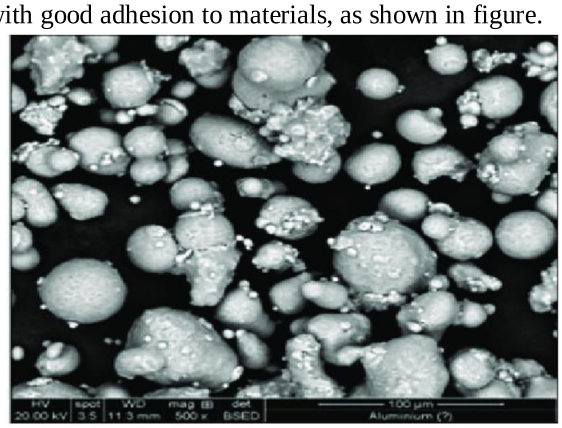


Figure 4. Aluminum 356 alloy

B. Corrosion Test

The electrochemical corrosion behavior of super Hydrophobic coated metal matrix composites, fabricated via stir casting was investigated using potentiodynamic polarization curves. Corrosion tests were conducted on samples in the RD-TD plane (rolling and transverse direction), extracting corrosion parameters such as current density and corrosion potential. Results show that the copper layer in the multilayered composite exhibits higher corrosion resistance compared to zinc and aluminum. As the number of stir casting increases, the corrosion potential becomes more negative, indicating decreased corrosion resistance. Macro-images of the material surface during different cycles reveal changes in matrial thickness, with aluminum and ZrB2 migrating to the outer surface. Consequently, the presence of aluminum and ZrB2 adjacent to copper reduces the corrosion resistance of the composite, leading to an increase in corrosion current density with higher stir casting cycles. In addition to experimental findings, it is noted that grain boundaries and residual strain play significant roles in the corrosion behavior of ultrafine-grained materials. Grain boundaries act as anodes, initiating corrosion, while grains act as cathodes. XRD results indicate a decrease in grain size of copper layers after the first cycle due to work hardening, resulting in increased corrosion rates compared to the primary copper sheet.

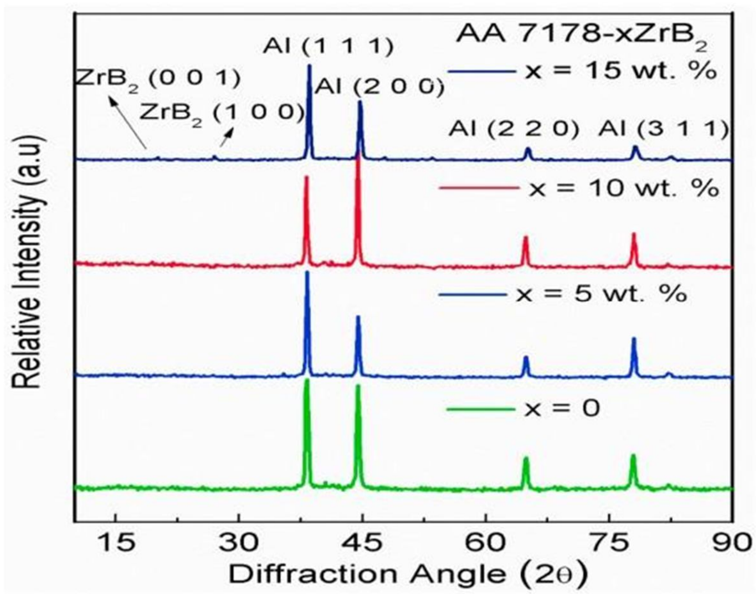


Figure 5. XRD graph

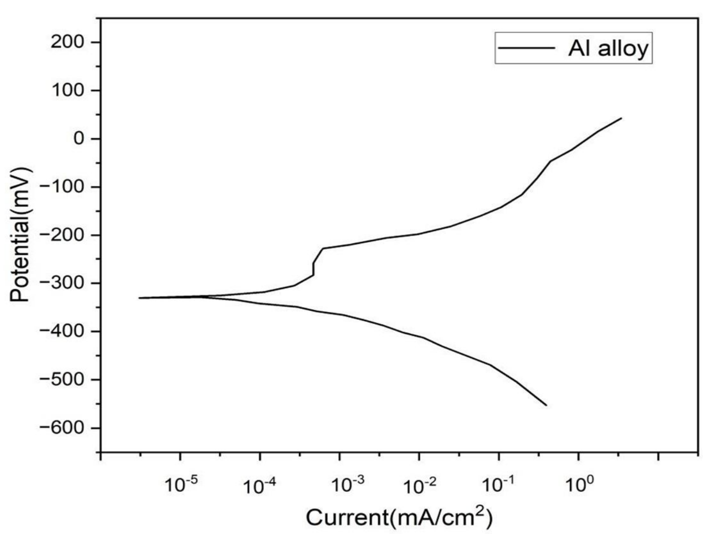


Figure 6. Corrosion graph of alloy

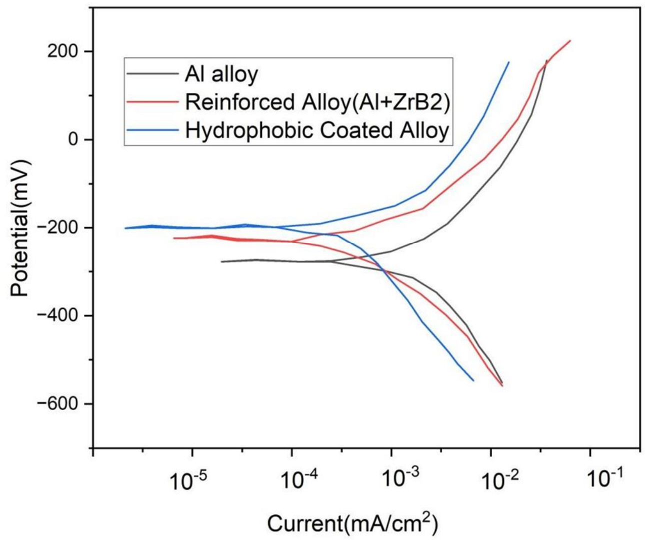


Figure 7. Corrosion graph of hydrophobic coating alloy and (AL+ZrB2)

Furthermore, super hydrophobic-coated metal matrix composites were subjected to corrosion tests in a 3.3% Sodium Chloride (NaCl) solution under various conditions. Graphite and a Calomel electrode served as the counter and reference electrodes, respectively. Polarization curves for uncoated and super hydrophobic-coated samples demonstrate the enhanced corrosion resistance of super hydrophobic-coated materials. An observed trend suggests that as deposition time increases, the corrosion resistance of the super hydrophobic coating film also increases, highlighting the potential of super hydrophobic coatings for corrosion protection in multilayered composites

IV. OVERALL CONCLUSION

In conclusion, the combination of metal matrix composites (MMCs) reinforced with zirconium diboride (ZrB2) particles and the application of superhydrophobic coatings offer a compelling solution for enhancing material properties and functionality across various industrial applications. Through extensive research and experimentation, it has been demonstrated that the addition of ZrB2 reinforcement into metal matrices, particularly aluminum alloys, results in significant improvements in mechanical performance, including enhanced tensile strength, yield strength, and hardness. These enhancements contribute to the overall durability and reliability of MMCs, making them well-suited for use in structural components subjected to high loads and abrasive wear conditions.

Moreover, the application of superhydrophobic coatings onto MMC surfaces further augments their performance by imparting water-repellent properties. These coatings facilitate self-cleaning and minimize water adhesion, thereby reducing the risk of corrosion and environmental degradation. This is particularly advantageous in applications where exposure to moisture and harsh environmental conditions is common, such as marine structures, automotive components, and aerospace applications.Overall, the synergistic combination of MMCs with ZrB2 reinforcement and superhydrophobic coatings represents a promising approach for addressing corrosion and environmental degradation challenges while improving material performance and longevity. Continued research and development in this field will be crucial for refining fabrication techniques, optimizing coating formulations, and exploring new applications to fully harness the potential of this innovative combination in various industrial sectors.

REFERENCES

[1] T. Rajmohan, K. Palanikumar, S. Ranganathan, Evaluation of mechanical and wear properties of hybrid aluminium matrix composites, Trans. Nonferrous Metals Soc. China 23 (9) (2013) 2509–2517, https://doi.org/10.1016/S1003-6326(13)62762- 4.

[2] D. Yadav, R. Bauri, Nickel particle embedded aluminium matrix composite with high ductility, Mater. Lett. 64 (6) (2010) 664–667, https://doi.org/10.1016/j. matlet.2009.12.030.

[3] A. Baradeswaran, A.E. Perumal, Effect of graphite on tribological and mechanical properties of AA7075 composites, Tribol. Trans. 58 (1) (2015) 1–6, https://doi. org/10.1080/10402004.2014.947663.

[4] A. Baradeswaran, A.E. Perumal, Wear and mechanical characteristics of Al 7075/ graphite composites, Composer B 56 (2014) 472–476, https://doi.org/10.1016/j. compositesb.2013.08.073.

[5] S.D. Kumar, M. Ravichandran, Synthesis, characterization and wire electric erosion behaviour of AA7178-10 wt.% ZrB2 composite, Siliconindia 10 (2018) 2653–2662, https://doi.org/10.1007/s12633-018-9802-7.

[6] K. Suganuma, T. Fujita, K. Niihara, T. Okamoto, M. Koizumi, N. Suzuki, Hot extrusion of AA 7178 reinforced with alumina short fibre reinforced with alumina short fibre, Mater. Sci. Technol. 5 (3) (1989) 249–254, https://doi.org/10.1179/ mst.1989.5.3.249.

[7] P.B. Pawar, R.M. Wabale, A.A. Utpat, A comprehensive study of aluminum based metal matrix composites: challenges and opportunities, Mater. Today Proc. 5 (11) (2018) 23937–23944, https://doi.org/10.1016/j.matpr.2018.10.186.

[8] H.B.M. Rajan, S. Ramabalan, I. Dinaharan, S.J. Vijay, Synthesis and characterization of in situ formed titanium diboride particulate reinforced AA7075 aluminum alloy cast composites, Mater. Des. 44 (2013) 438–445, https://doi.org/ 10.1016/j.matdes.2012.08.008.

[9] M.G. Mckimpson, T.E. Scott, Processing and properties of metal matrix composites containing discontinuous reinforcement, Mater. Sci. Eng., A 107 (1989) 93– 106, https://doi.org/10.1016/0921-5093(89)90378-X.

[10] S. Gopalakrishnan, N. Murugan, Production and wear characterisation of AA 6061 matrix titanium carbide particulate reinforced composite by enhanced stir casting method, Composer B 43 (2012) 302–308, https://doi.org/10.1016/j. compositesb.2011.08.049.

[11] S.K.M. Pathak, S. Das, S.K. Das, P. Ramachandrarao, Sintering studies on ultrafine ZrB2 powder produced by a self-propagating high-temperature synthesis process, J. Mater. Res. 15 (11) (2000) 2499–2504, https://doi.org/10.1557/ JMR.2000.0359.

[12] P.R. Rajkumar, C. Kailasanathan, A. Senthilkumar, N. Selvakumar, A. John Rajan, Study on formability and strain hardening index: influence of particle size of boron carbide (B4C) in magnesium matrix composites fabricated by powder metallurgy technique, Mater. Res. Express 7 (1) (2020), 016597, https://doi.org/10.1088/ 2053- 1591/ab6c0b.

[13] S.B. Prabu, L. Karunamoorthy, S. Kathiresan, B. Mohan, Influence of stirring speed and stirring time on distribution of particles in cast metal matrix composite, J. Mater. Process. Technol. 171 (2) (2006) 268–273, https://doi.org/10.1016/j. jmatprotec.2005.06.071.

[14] T. Satish Kumar, R. Subramanian, S. Shalini, Synthesis, microstructural and mechanical properties of ex situ zircon particles (ZrSiO4) reinforced metal matrix composites (MMCs): a review, J. Mater. Res. Technol. 4 (2015) 333–347, https:// doi.org/10.1016/j.jmrt.2015.03.003.

[15] N. Muralidharan, K. Chockalingam, I. Dinaharan, K. Kalaiselvan, Microstructure and mechanical behavior of AA2024 aluminum matrix composites reinforced with in situ synthesized ZrB2 particles, J. Alloys Compd. 735 (2018) 2167– 2174, https://doi.org/10.1016/j.jallcom.2017.11.371.

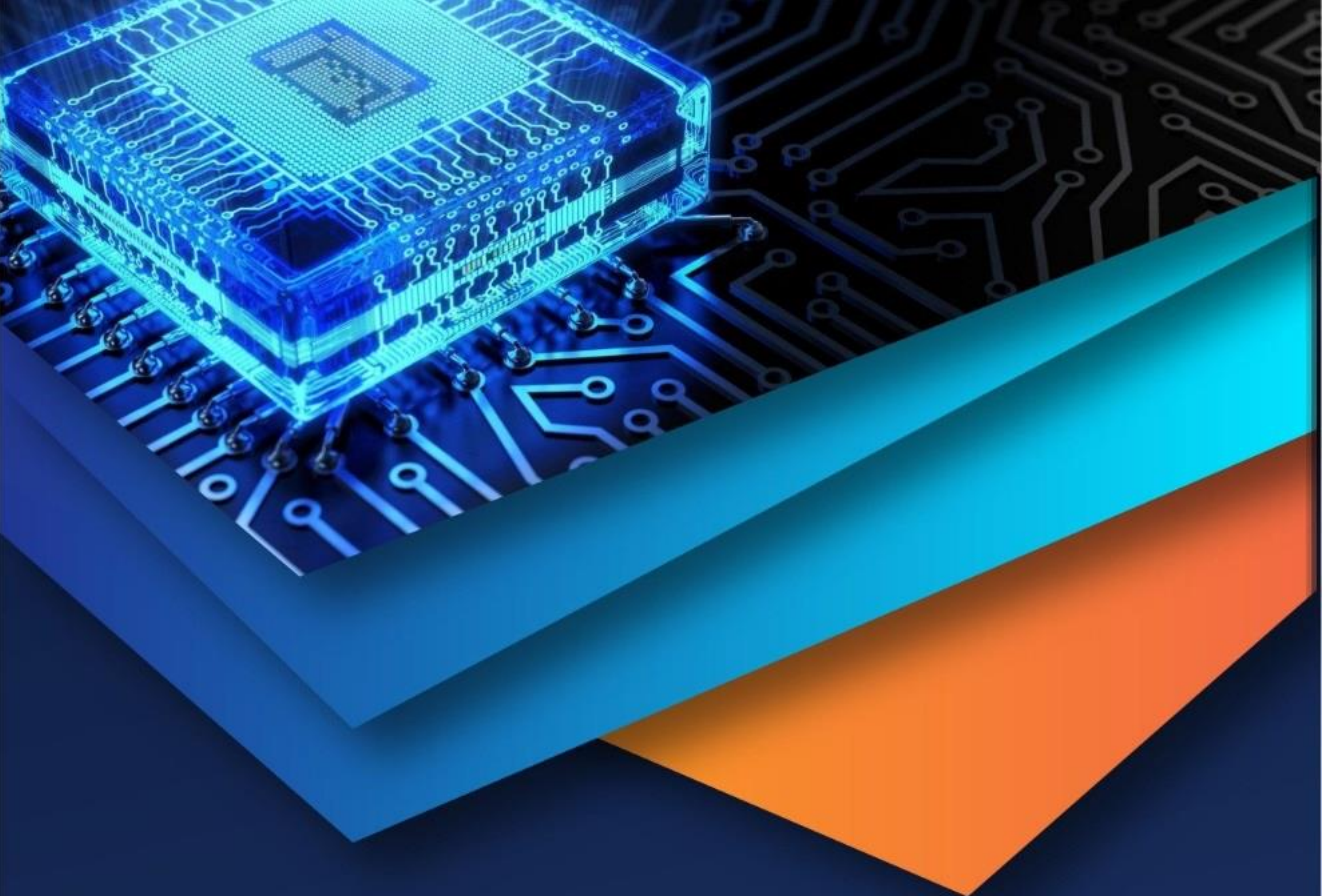
[16] K.J. Lijay, J.D.R. Selvam, I. Dinaharan, S.J. Vijay, Microstructure and mechanical properties characterization of AA6061/TiC aluminum matrix composites synthesized by in situ reaction of silicon carbide and potassium fluotitanate, Trans. Nonferrous Metals Soc. China 26 (2016) 1791–1800, https://doi.org/10.1016/ S1003- 6326(16)64255-3.

[17] T. Huang, G.S. Frankel, Kinetics of sharp intergranular corrosion fissures in AA7178, Corrosion Sci. 49 (2) (2007) 858–876, https://doi.org/10.1016/j. corsci.2006.04.015.

[18] C. Monticelli, F. Zucchi, G. Brunoro, G. Trabanelli, Stress corrosion cracking behaviour of some aluminium-based metal matrix composites, Corrosion Sci. 39 (10– 11) (1997) 1949–1963, https://doi.org/10.1016/S0010-938X(97)00088-7.

[19] T.M. Yue, Y.X. Wu, H.C. Man, Laser surface treatment of aluminium 6013/SiCp composite for corrosion resistance enhancement, Surf. Coating. Technol. 114 (1999) 13–18.

[20] S. Candan, An investigation on corrosion behaviour of pressure infiltrated Al– Mg alloy/SiCp composites, Corrosion Sci. 51 (2009) 1392–1398, https://doi.org/ 10.1016/j.corsci.2009.03.025.



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