strength equal to 21.88 and 11.24 MPa, respectively. This result indicates that the best curing condition (higher strength) is also the one which is more sustainable. M2/25°C and M2/60°C showed values equal to 19.60 and 19.14 MPa, confirming good results without the need of curing temperature increase. Finally, M3/25°C and M3/60°C reported values equal to 17.87 and 19.03 MPa, respectively. The general conclusion is that optimized geopolymers can be a high value added solution for the simultaneous recovery of water treatment sludge and clayey sediments after calcination.

DURABILITY BEHAVIOR OF BIO-EPOXY/JUTE-BASALT HYBRID COMPOSITES FOR CLADDING

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Introduction: The technology of dry assembly to produce multi-layer panels is an efficient alternative to traditional systems. Eco-sustainable systems are increasingly studied, particularly fiber reinforced composites for external cladding, based on natural fibers. However, the durability of these composites gives serious concern, in particular for their potential use in outdoor applications. To overcome this drawback, hybridization of natural fibers with mineral fibers as basalt ones appears promising. In this paper, the aging resistance of jute-reinforced laminate was compared with those of two hybrid laminates.
Materials and methods: A bio-based epoxy, named Super Sap 100/1000, was used as matrix. The laminates were manufactured through vacuum infusion and cured for 12 h at room temperature. All the laminates were manufactured by varying the number of layers to obtain similar volume fractions (i.e. ~30%) and thicknesses (i.e. ~5.50 mm). In particular, jute reinforced laminate was manufactured using eight layers of jute plain weave fabric (areal density of 290 g/m^2). The hybridization of jute was performed using unidirectional basalt fabrics (areal density of 300 g/m^2). Two hybrid laminates were manufactured. In the first one, layers were stacked as a sandwich sequence with six jute reinforced layers as core and two basalt layers as skins, for each side of the laminate. In the second hybrid laminate, jute layers were alternatively stacked with basalt ones. The laminates were exposed to accelerated aging in a climatic chamber developing aging cycles of hygrothermal stress and UV radiation, for a period of 56 days. Flexural tests, Charpy impact tests and dynamic mechanical tests (DMTA) were performed on specimens taken out from the climatic chamber at different exposition times (i.e. 0, 14, 28 and 56 days).
Results: The results showed that the flexural properties of the unaged hybrid laminates (i.e. both sandwich and intercalate configuration) are higher than those of the unaged jute laminates. In particular, the flexural strength and modulus of the sandwich laminate are 73% and 88% and the ones of the intercalated laminate are 112% and 110% higher than those of jute laminate, respectively. Moreover, the aging exposition leads to the slightest decrease of these properties for the sandwich laminates.
As concerns the impact properties, an improvement of the strength is found at the beginning of the aging exposition followed by a subsequent decrease, for each laminate. Even in this case, the sandwich configuration showed the best behavior. The DMTA showed that all the laminates, in the first phases of the aging, showed an increment of the Tg values and a decrease of the tan δ peaks. An inversion of both trends is found after 28 aging days.
Discussion: All the achieved results can be explained taking into account three competitive mechanisms (i.e. post-curing, plasticization and degradation phenomena). Anyway, these mechanisms affect the aging behavior of the laminates in a different way thanks to the protective role played by the external basalt layers. In particular, the sandwich configuration represents the best solution thanks to both thicker external basalt layers and lower number of basalt/jute interfaces.

NEW HEAT RESISTANT β-TI ALLOYS

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Introduction: Titanium alloys can be classified in three main groups, α, β and α - β according to their structure.
Among these, β-Ti alloys display good mechanical properties at medium-high temperature and are cold formable in most cases. However Ti alloys for aeroengines applications may undergo the so-called "titanium fire" under operating conditions. Burn resistant alloys are known in the ternary Ti-V-Cr system. The present work explores a few new compositions of this alloy family.
Materials and methods: Alloys with composition $Ti_{60}V_{20}Cr_{20}$, $Ti_{60}V_{20}Cr_{10}Zr_{10}$, $Ti_{60}V_{20}Cr_{18}Zr_1Ru_1$ and $Ti_{60}V_{20}Cr_{16}Zr_2Ru_2$ at.% were prepared by arc melting high purity elements.
Phase constitution was checked by microscopy and x-ray diffraction. The hardness has been tested by Vickers indentation and rolling deformation has been established at room temperature. Oxidation tests were performed by measuring mass gain.
Results and discussion: Three alloys ($Ti_{60}V_{20}Cr_{20}$, $Ti_{60}V_{20}Cr_{18}Zr_1Ru_1$ and $Ti_{60}V_{20}Cr_{16}Zr_2Ru_2$) were found to be fully b after arc melting. The alloy $Ti_{60}V_{20}Cr_{10}Zr_{10}$ is resulted a+b. The b microstructure is retained up to the highest temperature reached in this work (800°C) with minor precipitation of a Laves phase. The hardness spans a range between 370 HVN and 450 HVN both in the as-cast and annealed states.
The alloys can undergo deformation up to 4-5% before the development of cracks at room temperature.
The mass gain because of oxidation remains below 1 mg/cm^2 up to 600°C and increases to 9 mg/cm^2 when annealing for 15 h at 800°C.

HYDROGEN EMBRITTLEMENT OF A MARTENSITIC STAINLESS STEEL: INFLUENCE OF CATHODIC POTENTIAL

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Introduction: It is well known that in the presence of H_2S, metals, such as carbon and low alloy steels, may suffer hydrogen embrittlement (HE); prevention is carried out limiting the hardness of the material, according to ISO standard 15156. It is also well known that for high strength steels cathodic overprotection can favour hydrogen embrittlement (HE) even in absence of H_2S.
In the paper the effect of potential and residual stresses on the susceptibility to hydrogen embrittlement is studied.
Materials and methods: The studied material is a high strength martensitic stainless steel type AISI 420 (quenched and tempered), hardness 58 HRC, very susceptible to hydrogen embrittlement. Constant deformation tests (three point bending) according to NACE TM0177 method B have been carried out on Bent-Beam specimens cathodically polarised in acetic solution, pH 5.5 at room temperature, without addition of H_2S: specimens have been stressed at different level in the elastic range (from 20 to 90% of the yield strength).
Results: At potential higher or equal to -0.70 V vs E_{Ag} (Ag/AgCl/3 mol L^{-1} Cl^-) and for stresses lower than the yield strength (YS), the material AISI 420 C appears not susceptible to hydrogen embrittlement. At potential less noble than -0.70 V (vs E_{Ag}), the threshold stress is lowered, for example at E = -0.90 V (vs E_{Ag}) tends to values around 60% of YS.
The presence of defects, as residual stresses, worsens significantly the behaviour. Critical stress threshold is lowered to 20% of the yield strength and time to failure is reduced.
In case of absorption of hydrogen prior the testing, even without failure of the specimens and in conditions that promote the release of a large amount of hydrogen previously absorbed, the results are more critical: in correspondence with the threshold stress the time to failure is reduced and the number of failed specimens is increased even at more noble potentials.
Discussion: The experimental results showed that, even in the case of a material highly susceptible to HE, it is possible to find protection potential/applied stress fields where this type of damage is not probable. Assuming more severe and conservative conditions, like the presence of residual stresses due to mechanical damage, the threshold of these fields is modified significantly.
Nevertheless, in the case of tougher material and less susceptible to HE, these results suggest the possibility to prevent hydrogen embrittlement by means of proper application of cathodic protection. In any case, the operating parameters (protection potential) shall be assessed through suitable testing carried out in conservative and critical conditions.