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Development of dual phase steels and studies on accelerated corrosion testing of dual phase steels of varying martensite content by salt spray test

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New class of high strength low alloy steels (HSLA) known as dual phase steels (DP steels) have a distinctive microstructure which consist of a ferrite matrix with particles of martensite. Commonly, low carbon steels with 80% ferrite and 20% martensite is regarded as DP steels. It is known that DP steels with varied percentage of martensite can be prepared from high strength low alloy steels by intermediate heat treatment. These steel so prepared have a combination of remarkable mechanical properties such as high tensile strength, good ductility as well as, high work hardening rate at early stages of plastic deformation which distinguishes them from HSLA steels. To obtain DP steels of higher martensite content, 14 mm thick high strength low alloy steel samples were austenized at 920°C and quenched in iced-brine solution at -7°C followed by heat treatment at various inter critical temperatures and finally quenched in servo quench 707 at a temperature of 25°C. The percentage of carbon in the samples were 0.13% and the inter critical temperatures varied from 730°C to 810°C. Salt spray test is one of the accelerated corrosion testing methods for predicting the lifetime of a product. In order to study the corrosion resistance of DP steel with varying percentage of martensite, neutral salt spray test as per ASTM G-85 and ASTM B-117 standards with 5% by weight NaCl as corrosive media was conducted. Test coupons of the required dimensions for different DP steels of varying percentage of martensite content were prepared as per ASTM G1 standard. The test duration was 96 hrs in steps of 24 hrs. It was found that the corrosion rate decreases with increase in percentage volume fraction of martensite.

Biography

U. N. Kempaiah obtained his B.E. in Mechanical Engineering from PDA College of Engineering, Gulbarga University during the year 1986 and his M.E. in Mechanical Engineering from University Visvesvaraya College of Engineering (UVCE), Bangalore University during the year 1991 and his Ph.D. in Mechanical Engineering from Bangalore University during the year 2002. He is currently working as Professor in the University Visvesvaraya College of Engineering, Bangalore, India. He has more than 25 years of teaching experience and is actively involved in research. He has published and presented a number of research papers in national and international journals and conferences. He has guided two research scholars for Ph.D. and at present guiding two more for their Ph.D. He is a member of many professional bodies like IE (India), IIM, IIWS, MISTE, etc.

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Novel biodegradable polyurethanes reinforced with green nanofibers for applications in tissue engineering

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New class of green biocomposites were designed and synthesized for tissue engineering applications. These newly introduced non-cytotoxic, biodegradable polyurethane composites had different compositions (i.e., ratio of hard to soft segments) of the linear, aliphatic hexamethylene diisocyanate and polycaprolactonediol. The porosity was introduced in the polyurethane matrix using a combination of salt leaching and thermally induced phase separation (TIPS). The resulting interconnected pore size was characterized using scanning electron microscope (SEM) to be between 125-355 µm. Porosity was determined using liquid displacement and found to be between 70-75% for non-reinforced matrices, 64-70% for reinforcement with 5 wt% biocellulose nanofiber (BCNF), 59-69% for 10 wt% BCNF, and 57-69% for 15 wt% BCNF biocomposite samples. Dependent on the composition, compressive strength showed up to a little less than two-fold increase (85%) for green BCNF reinforcement of 5 wt% and more than two-fold increase (120%) for 10 wt%. The tensile strength also increased up to almost two-fold (114%) for reinforcement with 5 wt% BCNF and to more than two-fold (140%) for 10 wt% reinforcement. Higher degrees of reinforcement showed a detrimental effect on both properties. Properties demonstrate that this novel class of nanostructured biocomposite holds potential to be utilized as scaffolds for tissue regeneration.

Keywords: Green biocellulose nanofibers, and reinforced PU scaffold.

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