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ENGINEERING AT THE NANOSCALE: A STRATEGY FOR DEVELOPING HIGH PERFORMANCE FUNCTIONAL ECO-FRIENDLY POLYMER NANOCOMPOSITES

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This talk will concentrate on various approaches being used to engineer materials at the nanoscale for various applications in future technologies. The case of clay, carbon nanostructures (e.g., nanotubes, graphene), metal oxides, bionanomaterials (cellulose, starch and chitin) will be used to highlight the challenges and progress. Several bio-degrdable polymer systems will be considered such as rubbers, thermoplastics, thermoetts and their blends for the fabrication of functional polymer nanocomposites. The interfacial activity of nanomaterials in compatibilising binary polymer blends will also be discussed. Various self-assembled architectures of hybrid nanostructures can be made using relatively simple processes. Some of these structures offer excellent opportunity to probe novel nanoscale behavior and can impart unusual macroscopic end properties. The author will talk about various applications of these materials, considering their multifunctional properties. Some of the promising applications of clay, metal oxides, nano cellulose, chitin, carbon nanomaterials and their hybrids will be reviewed.

NEXT GENERATION THERMAL BARRIER COATINGS FOR AEROENGINE APPLICATIONS; BOND COAT MATERIALS

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Bond coats (BCs) based on βNiAl matrix are commonly employed in thermal barrier coating systems (TBC) for aero-engine applications. The addition of reactive elements (REs) such as; Zr, Hf and Y in βNiAl are being researched extensively since they offer improved oxidation performance at high temperatures. In this study, experimental findings will be presented on the βNiAl matrix-based BCs that were prepared onto CMSX-4 superalloy with and without additions of Zr and Hf using an *in-situ* chemical vapor deposition (CVD) method. The BCs were isothermally oxidized at 1150°C for 100 hours in laboratory air. The processing of REs-βNiAl and their effects on oxidation were studied in comparison to undoped βNiAl. This was followed by characterization techniques including TEM, FIB, ASTAR analysis; SEM, XRD, Proto iXRD and Raman spectroscopy/PLPS. The REs doped βNiAl were successfully prepared using *in-situ* CVD technique. BC performance is discussed in detail such as thermally grown oxide (TGO) phases, stresses, morphologies etc. In general, TGO formed due to oxidation of REs doped samples consisted of alpha alumina alone; on contrary mixture of TiO_2, $NiAl_2O_4$, θ-Al_2O_3 and α-Al_2O_3 was seen in their undoped counterparts. In addition, the TGO growth rate and residual stresses on REs-βNiAl were found to be lower than that of the undoped βNiAl. In addition, oxide pegging (OP) due to REs were also analyzed using TEM with the aid of FIB this was followed by ASTAR indexing. The OP was emerged to be one of key features of REs doped BCs which is crtical factor for lifespan of the TBC.

Note: