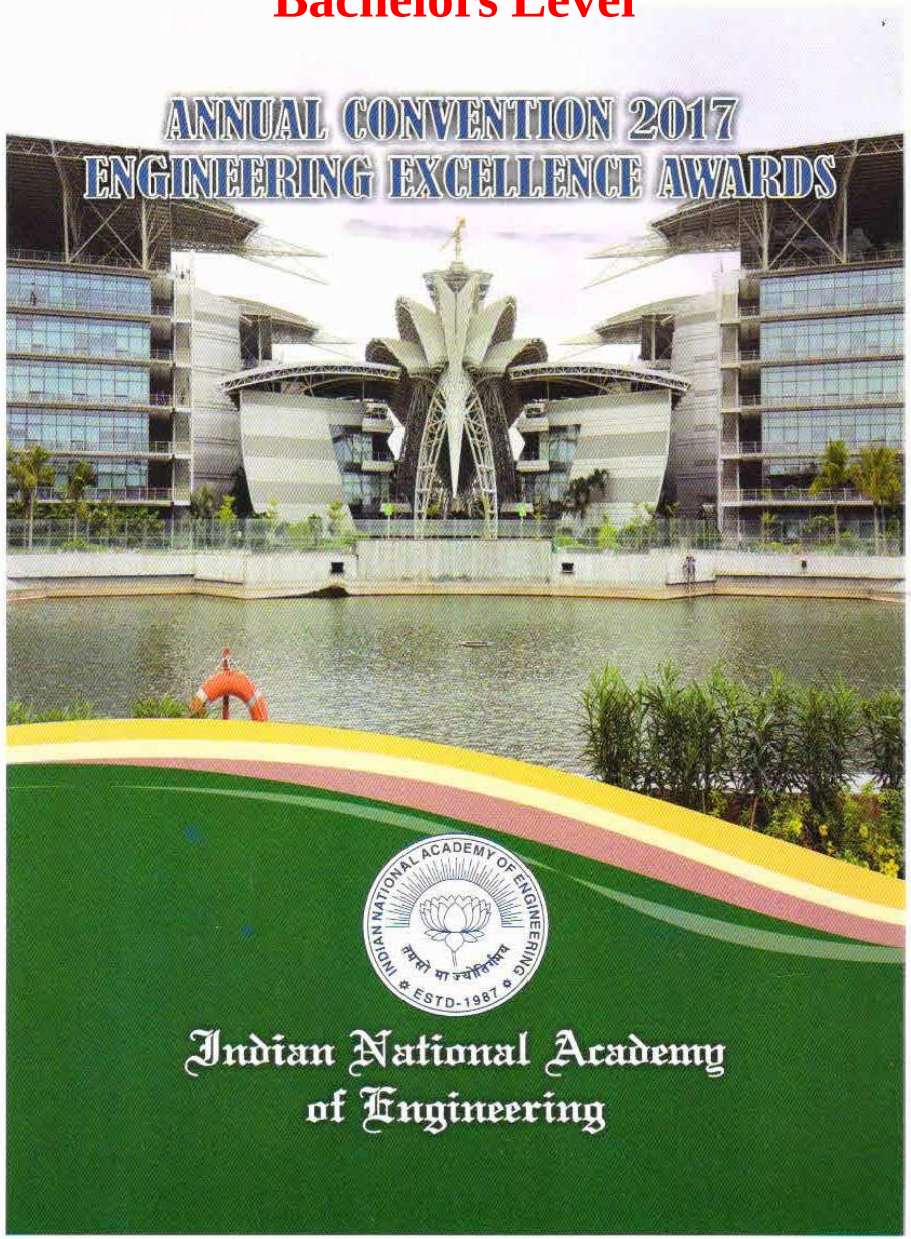
Innovative Student Projects Award 2017
Bachelors Level



Department of Metallurgical and Materials Engineering



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Title of the Project: Preliminary Evaluation of High Temperature Protective Coating for C_f-SiC Composite.

Summary of project: Carbon-fiber-reinforced SiC composites (C_f-SiC) are intended for use in high temperature structural applications for hypersonic flight vehicles, where the temperatures are in excess of 1300°C. However, C_f-SiC composites undergo dimensional degradation due to oxidation at high temperatures; Therefore, the application of protective coatings is indispensable for the use of C_f-SiC in strategic applications.

The present study is aimed to develop suitable multi-layer high temperature protective coatings against high temperature oxidation of the C_f-SiC composite. Various multilayer high temperature protective coatings, comprising Si/mullite/yttrium-silicate/yttria, were deposited using Atmospheric Plasma Spray technique. Cyclic oxidation tests of the coated composite were carried out in air at 1400°C and the relative oxidation performance evaluated. Microstructural and compositional analyses were carried out by using SEM and EDS. The study revealed that the sequence of multilayer coatings had a significant effect on the oxidation performance. The best oxidation resistance was achieved for the multilayer coating which had Si as the inner layer, mullite and yttrium silicate as the successive intermediate layers, and yttria as the outer layer. The oxidation resistance offered by the various coatings are ranked as: 1. Si/mullite/yttrium-silicate/yttria, 2. Si/mullite/yttrium silicate, 3. mullite/yttrium-silicate/yttria, 4. mullite/yttrium-silicate, and 5. yttrium-silicate, in the decreasing order.