CVD COATING OF SAPPHIRE FIBERS WITH hBN TO IMPROVE MECHANICAL PROPERTIES OF REINFORCED NiAl COMPOSITES

K. Reichert*, R. Cremer**, D. Neuschütz

Materials Chemistry, RWTH Aachen,
D-52056 Aachen, Germany
Tel +49(0)-80-25970, Fax +49(0)-80-22295,
email neuschuetz@mch.rwth-aachen.de
*now with ALSTOM (Switzerland) Ltd, CH-5401 Baden, Switzerland
** now with Cemecon AG, D-52146 Würselen, Germany

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ABSTRACT

Thermal atmospheric pressure CVD of hexagonal boron nitride from trimethylborazine (TMB) in H_2 + 3 % NH_3 at 925 °C has been used to deposit 1 to 3 µm single-phase *h*-BN on sapphire fibers with the aim of forming a weak bonding in an Al_2O_3 fiber/NiAl matrix composite to overcome low-temperature brittleness of NiAl.

The hexagonal structure of BN was clearly identified by means of reflexion electron energy loss spectrometry (REELS). During high-temperature applications, the fiber-matrix bond has to be strengthened to overcome poor NiAl creep resistance. We have shown that *h*-BN reacts with NiAl at elevated temperatures to form AlN (and boron dissolved in NiAl), thus loosing its lubricating property. Furthermore, the fiber-matrix bond strength has been increased by adding yttrium to the composite. At 1100 to 1300 °C, Y gradually reacts with Al_2O_3 to form the Y-Al garnet $Y_3Al_5O_{12}$ (YAG), thus roughening the sapphire fibers and strengthening the interface bonding.