A MICROSTRUCTURAL STUDY OF A Si_3N_4 CERAMIC PREPARED BY HOT ISOSTATIC PRESSING

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Silicon nitride is one of the most promissing material for high temperature applications due to it's outstanding physical properties at high temperatures. Si_3N_4 is a covalently bonded solid and hence the self diffusivity is low for solid state sintering. Therefore to obtain a high density strong material, sintering additives such as MgO, Y_2O_3 etc. are required to provide a liquid phase for sintering. However, this liquid forms a residual intergranular glassy phase upon cooling. The high temperature properties of Si_3N_4 are limited by the properties of this glassy phase and often this phase makes negative effect on high temperature performance. However, with the development of hot isostatic pressing (HIP) technique it is now possible to make fully densified Si_3N_4 ceramics with low amounts of sintering aids.

This paper presents the general microstructure of a HIP:ed Si_3N_4 ceramic containing 4% wt. of Y_2O_3. Analytical electron microscopy and X-ray diffractometry have been used to characterise the microstructure. The investigations revealed that this material contains α and β -Si_3N_4, an yttria rich crystalline second phase, probably α - $Y_2Si_2O_7$ and a residual intergranular glassy phase. It was observed that the many grains were faceted and the average grain size was about 0.5 μm.

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