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## ÍNDICE

**Residual strain scanning of alumina-based ceramic composites by neutron diffraction**

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Alumina-based ceramic composites are considered a candidate material for certain structural applications, namely as thermal insulation barriers in motors and turbines and as biomaterials in implants. However, in order to be used for this purpose, their mechanical and fracture properties need to be enhanced. This has been studied for decades and several toughening mechanisms have been proposed. In some cases, the poor fracture behaviour has been attributed to detrimental residual stresses, although definitive experimental support is sometimes lacking. These stresses may arise during cooling from the sintering temperature, due to the differences in the thermal expansion coefficients of the matrix and the reinforcement. Consequently, in order to improve the durability and the structural integrity of ceramic composites, it is necessary to understand the nature and the magnitude of residual stresses generated in the fabrication process.

Two different ceramic systems were investigated: $Al_2O_3/Al_2TiO_5$ (alumina/aluminium titanate) and $Al_2O_3$/Y-TZP (alumina/tetragonal $ZrO_2$ stabilized with 3 mol% $Y_2O_3$). Monolithic and layered structures were obtained by different processing routes. In addition, the effect of different reinforcement volume fractions was also studied.

Residual stresses were measured by neutron diffraction on the strain imager SALSA [1], at the ILL, Grenoble, France. SALSA features a Stewart Platform as a sample stage, which allows very flexible sample handling capabilities and arbitrary scan trajectories in the 3D space. In our case the wavelength used was 2.06 Å. The (double-focussing) Si-monochromator reflection (311) was used with a take-off angle of 85°. A 2D position sensitive detector with an angular opening of approximately 5° was mounted on SALSA. Primary and secondary slits were used. The gauge volume (which can be varied automatically via step motors) was set to $1\times1\times10$ mm$^3$. Typical counting times with this set-up vary from 1 to 5 min for $Al_2O_3$.

The objective of this work is to non-destructively determine the residual stress profile in the bulk of two characteristic types of alumina-based composites, with the aim of improving their durability and structural integrity.

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**References:**
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