NUMERICAL PREDICTION OF LINEAR THERMAL PROPERTIES OF FGM COMPOSITES

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ABSTRACT

Functional Graded Material (FGM) composites are used in many applications that require dual features, which may not be available in conventional materials. Predicting the physical behaviour of such FGM composites is a key challenge. Analytical modelling is a common methodology in predicting such physical behaviour based on the rule of mixture, which makes it unique to a certain composite type and doesn't qualify for a general use. Recently, voxel based representative volume elements have been used based on electron scanning microscope of the composite to numerically predict the composite properties. In the current paper, a numerical finite element modelling approach using ANSYS® to predict the linear thermal properties of FGM composites is proposed. The composition of the FGM is determined using a randomization algorithm. This new approach is based on general data of the constituent materials of the composite, and does not require prior measurements or scanning of the composite. The proposed model has been compared to experimental measurements of thermal conductivity of different composites. It has also been compared to various rule of mixture models as well as the voxel based representative volume elements model. Results have shown good agreement with experimental results. The effect of porosity and constituent property ratios on the accuracy of the rule of mixture models has also been studied.