Multi-scale analysis for refractory fabric composites using FEA

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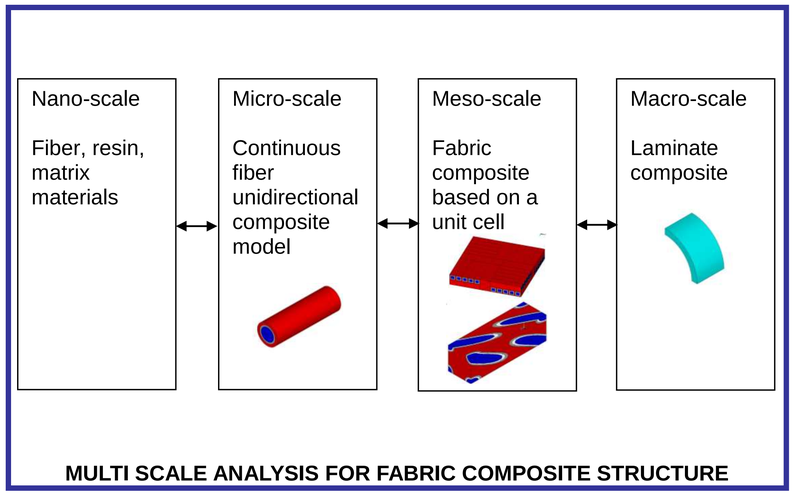
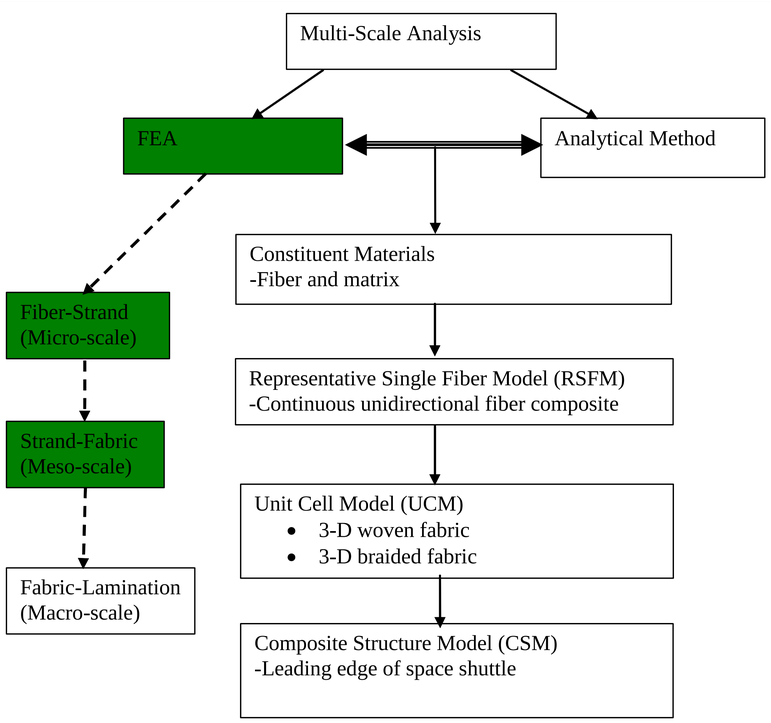
INTRODUCTION

The objective of this study is to develop a modeling technique for designing refractory fabricated composites. In order to have optimal composite structure, several models of plain weave and 3-D braided composites were evaluated in the effective mechanical and thermal material properties

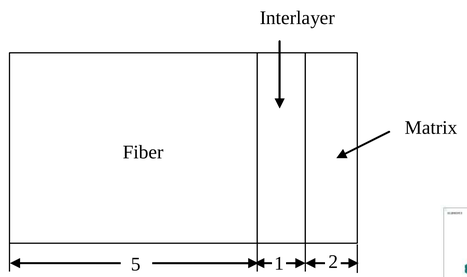




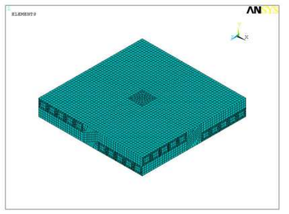
Multi-scale analysis flow chart

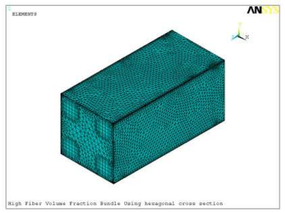
NEW APPROACH

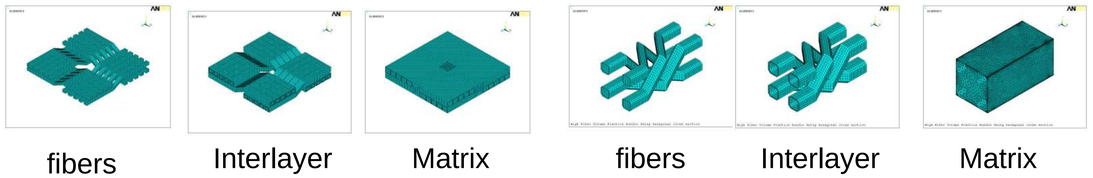
Thermal stresses on the refractory fabric composites due to CTE mismatch of constituent materials can be reduced by sliding effect using weak interlayer.
A series of finite element analysis models were developed from the constituent material levels such as the fiber, interlayer, and matrix materials at the micro-scale level to the woven fabric and braided composite as the meso-scale level



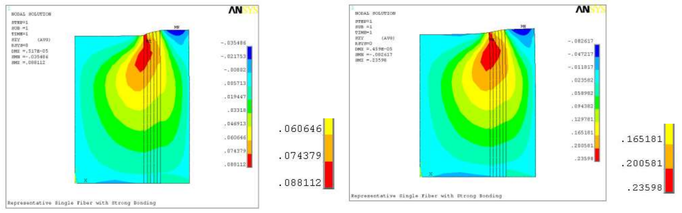
Axisymmetric Unidirectional representative single fiber at micro-scale





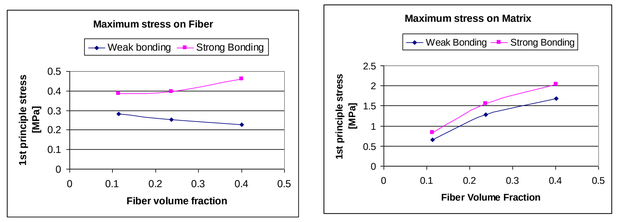


Finite element models of unit cell at meso-scale

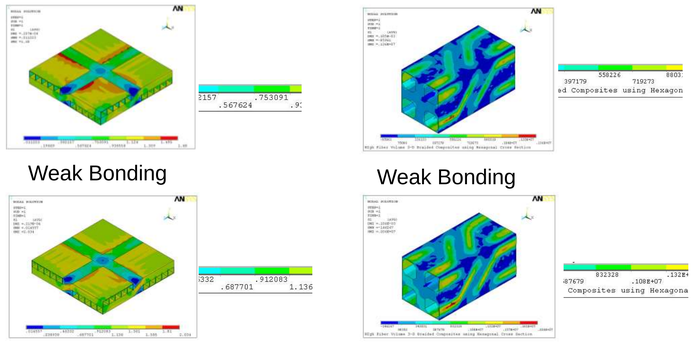


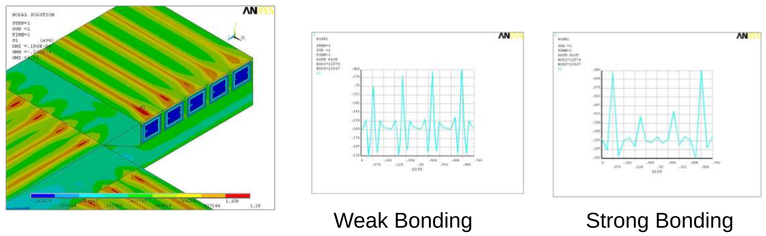
Weak bonding Strong bonding

Results in Shear stresses by unit temperature change



Results of Parametric Study for plain weave composites





Results in thermal tresses by unit temperature change

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