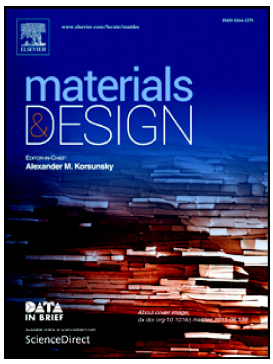

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Localized stress recoveries in hierarchical aligned porous materials with the influence of surface effects or interphases

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Abstract

In order to study the micromechanical behavior of hierarchical aligned porous structures, an infinite plate with an arbitrarily shaped hole reinforced with a functionally graded hierarchical coating, is investigated. The coating is further composed of aligned porous materials with the considerations of surface effects or interphases/coatings. The solution is derived by following the Muskhelishvili approach at the higher structural level, while the locally exact homogenization theory model is employed to recover the microstructural stress distributions. It can be seen that even though certain magnitudes of stress concentrations already happen at the structural levels (depending on the shape of the hole), the local stress concentrations appear to be much larger. By changing the surface parameters of microstructures, the stress concentrations are varied within certain amounts. Moreover, the magnitudes of local stresses are significantly reduced with the existence of the coatings within the microstructures. Some conclusions are thus summarized: First, the mechanical behavior at higher structural level is not reliable in predicting the possible damages or cracks starting from the microstructures; second, both surface parameters and interphases/coatings in the microstructures play important roles in

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