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Numerical Determination of Diffusional Transformation Induced Plasticity from Computations of Random Microstructures

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Current theories for the modeling of transformation induced plasticity still fail to reproduce experimental results in cases where the material has undergone permanent strain preliminar to transformation process. There is no such discrepancy when using Finite Elements modeling with classical plasticity; furthermore this approach allows to control the nucleation rate and spatial distribution of the product phase, its morphology and its growth rate. Its drawback is the possible dependancy of results to computation parameters (mesh size . . .), an aspect that has been addressed in details so to determine valid configurations of computations. We have observed that one should resort to a huge mesh to get a response representative of an effective medium in the case where nucleates are randomly positionned. Assuming ergodicity, this problem is circumvented by performing ensemble averages over sub-domains extracted randomly from the bulk material, a classic method adapted for phase transformation for the first time.

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