Localized versus diffused failure modes in concrete subjected to high temperature

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ABSTRACT

In this work, conditions for discontinuous bifurcation in limit states are derived and evaluated in quasi-brittle materials like concrete, for variable stress states, loading conditions and high temperature scenarios. This is performed in the framework of a thermodynamically consistent non-local poroplastic constitutive theory for quasi-brittle materials subjected to high temperature [1]. Thereby, gradient poroplasticity and fracture energy-based homogenization are combined to describe the post peak behavior of porous media when subjected to long term exposure of temperature.

For the numerical implementation of the model, the consistent tangent operator is developed and the dual mixed FE formulation for thermodynamically consistent gradient plasticity by Vrech and Etse [2] is considered, which was extended to porous media by Mroginski and Etse [3].

The explicit solutions for brittle failure conditions in the form of discontinuous bifurcation as well as the formulation for the localization ellipse, are proposed for this poroplastic constitutive theory based on gradient plasticity. The results provide relevant information regarding the variation of the transition point of brittle-ductile failure mode with the acting temperature and confining pressure.

REFERENCES

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