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# Hydrogen induced degradation in lattice material

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Lattice materials are lightweight, architectured materials with tailored properties. They are increasingly applied in automobile and aerospace engineering for the purpose of weight reduction, acoustic isolation and energy absorption. Similar to conventional materials, metallic lattice materials are susceptible to environmental fracture under service conditions, such as hydrogen embrittlement. Due to the unique structural characteristics, hydrogen can enter and diffuse in a lattice material without difficulty, which escalates hydrogen induced degradation. In this talk, we present an approach for simulating hydrogen induced degradation in lattice materials made from stainless steel. The simulation is based on computational elastoplastic homogenization, applied to a representative volume element with periodic boundary conditions. Hydrogen is assumed to redistribute in the matrix rapidly satisfying chemical potential equilibrium. Hydrogen enhanced localized plasticity mechanism is implemented by describing the matrix flow stress as a decreasing function of hydrogen concentration. The homogenized hydrogen influenced stress-strain curves are employed as measure for the assessment of hydrogen induced degradation on mechanical properties. The computational scheme is generic and applicable to any open-cell architectured material. Two types of lattice unit-cells are investigated and compared, highlighting the influence of lattice topology (architecture) on hydrogen resistance of the material.

## REFERENCES

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