VISCOPLASTIC CONSTITUTIVE EQUATOINS FOR COPPER TO MODEL CANISTER DEFORMATIONS AND IMPLEMENTATION IN CODE_BRIGHT

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ABSTRACT

Ultimate storage of spent nuclear fuel is located in copper canisters which are surrounded by bentonite clay. After placement of the canisters, Bentonite swelling due to water saturation and hydrostatic pressure cause the canisters will be subjected to compressive loads. The canisters are constructed with a load carrying cast insert of ductile iron which is surrounded by a 50 mm thick corrosion resistant copper shell. The copper shell is not in itself load carrying but must maintain its corrosion barrier ability when the compressive load is applied very slowly. For materials where the load is applied slowly, materials creep properties are of great importance. It has been shown that creep ductility for oxygen free copper can be very low (< 1 %). The objective of the paper is to develop algorithms describing rate-dependent (viscoplastic) constitutive equations (Bodner and Partom model) based on a single internal state variable which is a function of plastic work are used to calculate the response of copper to change of strain rate over a range of temperatures for copper canister and Implement it in Code_Bright. Bodner-Partom constitutive equations must be checked for their validity, for this purpose, the stress-strain response of a uniaxial tensile bar at a constant velocity was computed in Code_Bright and then the results were compared with the solution obtained from Stealth Finite Difference Code.

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