SM15L_13006

XXI International Congress of Theoretical and Applied Mechanics
Warsaw, Poland, August 15–21, 2004

Stresses and Fractures in Capillary-Porous Materials Under Drying

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A risk of fracture of saturated capillary-porous materials under drying was analyzed theoreti-cally and experimentally. The drying induced stresses were determined theoretically with the help of mechanistic model of drying developed in authors' earlier works. The viscoelastic be-havior of the material under drying based on the Maxwell model was assumed. The numerical calculations were carried out for the kaolin-clay sample shaped cylindrically. The theoretical time-evolution curves of the drying induced stresses were compared with the experimental time-evolution curves of the acoustic emission (AE) represented by the descriptors such as the intensity of AE events and the intensity of AE energy emitted by the material under drying. These two AE descriptors were monitored on line during convective drying of cylindrically shaped kaolin sample in laboratory drier. The analysis proved that the amount of emitted energy increased significantly at those periods, at which the theoretical stress curves reached their maximum. Since the energy of acoustic signals originates from micro- and macrocracks of the material structure, we conclude that the AE method may serve for identification of frac-ture intensity occurring in saturated capillary-porous materials during drying.

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