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One of the accepted approaches for postpeak finite-element modeling of RC comprises combining plain concrete, reinforcement, and interaction behaviors. In these, the postpeak strain-softening behavior of plain concrete is incorporated by the use of fracture energy concepts. This study attempts to extend this approach for RC at elevated temperatures. Prior to the extension, the approach is investigated for associated modeling issues and a set of limits of application are formulated. The available models of the behavior of plain concrete at elevated temperatures were used to derive inherent fracture energy variation with temperature. It is found that the currently used tensile elevated temperature model assumes that the fracture energy decays with temperature. The existing models in compression also show significant decay of fracture energy at higher temperatures (>400°) and a considerable variation in values. Application of the evaluated fracture energy values shows that these impose severe element size and reinforcement ratio limits. The effect of the limits is illustrated for a RC specimen. © 2013 American Society of Civil Engineers.

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