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## **Effect of kinematic hardening on localized necking in substrate-supported metal layers**

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Necking limit prediction in thin substrate-supported metal layers, used as functional components in electronic devices, represents nowadays an ambitious challenge. The aim of this work is to investigate the effect of kinematic hardening on localized necking in these elastomer-coated metal layers ([1]). The metal and elastomer layers are assumed to be isotropic, incompressible and strain-rate independent. The mechanical behavior of the metal layer is modeled by an extended version of the deformation theory of plasticity. This version takes into account both isotropic and kinematic hardening. The isotropic hardening is modeled by the Hollomon law, while the kinematic hardening is modeled by the Armstrong–Frederick law. The mechanical behavior of the elastomer layer is assumed to be hyperelastic and is modeled by a neo-Hookean constitutive law. The two layers are assumed to be perfectly adhered. Strain localization is searched for as a bifurcation phenomenon, meaning that a non-homogeneous straining mode becomes possible (i.e., the uniqueness of the solution of the rate equations is lost). The Rice bifurcation criterion ([2]) is used in order to predict the localization of plastic flow. The effects of the kinematic hardening, and the associated material parameters, on the necking limit strains are specifically highlighted. In particular, it is demonstrated that the limit strain increases with kinematic hardening.

[1] M. Ben Bettaieb and F. Abed-Meraim, *Int. J. Plast.*, 65, 168 (2015).

[2] J.R. Rice, In: 14th International Congress of Theoretical and Applied Mechanics, p. 207 (1999).

[1] A.B. Black, C.D. Grey and E.F. White, *J. Appl.Phys.*, 50, 1234 (1990).

[2] S. Wang, in *Focus on Multidimensional Microscopy*, Vol.1, p.567, P.C. Cheng, Ed. (World Scientific, Singapore, 1999).