
Symposium | A. Advances in Materials Theory for Multiscale Modeling

[SY-A9] Symposium A-9

Chair: Eliot Fried(Okinawa Institute of Science and Technology, Japan)

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[SY-A9]FTMP-based Seamless Description of Deformation-Fracture Transitions

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This study attempts to tackle one of the ultimate problems in mechanics of materials based on FTMP (Field Theory of Multiscale Plasticity), i.e., modeling deformation-fracture transitions. Three typical fracture modes are targeted: (1) ductile fracture, (2) creep rupture and (3) fatigue crack initiation, whose evolutions are respectively triggered or promoted by deformation-induced substructures. For (1), critical conditions governing the onsets of macro/micro instabilities are extensively discussed, while (2) is concerned with localized recovery-induced rupture in packet models for lath martensite structures, in connection with the interaction fields. The mode (3), on the other hand, is successfully reproduced via evolving PSB ladder structure and attendant vacancy formation/diffusion processes. A noteworthy output here is that the use of the corresponding duality diagram representations enables us to “visualize” these complex processes, manifested as dynamic energy conversion between fluctuating elastic strain