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Instabilities and turbulence originating from relaxation phenomena behind shock waves[1] MATEI I. RADULESCU, NICK SIRMAS, University of Ottawa — A strong shock is typically followed by a zone of energy relaxation. In gases, for example, this energy relaxation involves inelastic collisions among the molecules, during which the kinetic energy of the microscopic motion of the molecules is progressively transferred into the energy of the internal modes (vibration, ionization, etc...) as the medium equilibriates thermally. On the time scales of the relaxation process, the system acts as a dissipative medium, i.e. a system in which the energy available in the translational modes of motion of the molecules (which define pressure) is lost to the internal modes. In the present work, we study via molecular dynamic calculations the dynamics of shock waves driven through a dissipative molecular medium. The medium is modeled as a collection of hard disks undergoing inelastic collisions. We show that such a dissipative medium is unstable and forms distinctive high density and low pressure clustered non-uniformities by the Goldhirsch-Zanetti instability mechanism (Goldhirsch & Zanetti, Clustering instability in dissipative gases, Phys. Rev. Letters, 70(11), 1993). The results obtained may shed light on the turbulence observed experimentally behind strong shock waves and anomalous reactivity centers (hot-spots)in reactive media.

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