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Presentation of an approach for the analysis of the mechanical response of propellant under a large spectrum of loadings: numerical and mechanical issues

ALAIN FANGET, Centre d'Etudes de Gramat, 46500 France

Many authors claim that to understand the response of a propellant, specifically under quasi static and dynamic loading, the mesostructural morphology and the mechanical behaviour of each of its components have to be known. However the scale of the mechanical description of the behaviour of a propellant is relative to its heterogeneities and the wavelength of loading. The shorter it is, the more important the topological description of the material is. In our problems, involving the safety of energetic materials, the propellant can be subjected to a large spectrum of loadings. This presentation is divided into five parts. The first part describes the processes used to extract the information about the morphology of the meso-structure of the material and presents some results. The results, the difficulties and the perspectives for this part will be recalled. The second part determines the physical processes involved at this scale from experimental results. Taking into account the knowledge of the morphology, two ways have been chosen to describe the response of the material. One concerns the quasi static loading, the object of the third part, in which we show how we use the mesoscopic scale as a base of development to build constitutive models. The fourth part presents for low but dynamic loading the comparison between numerical analysis and experiments.