Behavior of porous matter along boundaries at the micro-scale under dynamic compression

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For shock experiments with porous matter the reflection method is widely in use. For calculations often the Mie–Grüneisen equation of state (EoS) is applied where a thickness of zero for the boundary surface between the reflector with higher impedance and the porous sample is used [1]. However, several experiments gave evidence that this assumption is not applicable. For the compaction of hard and brittle materials in the micro- or nanoscale and for the experimental work with powders the formation of a boundary zone during shock compaction is evident. It was shown with different analitical methods (optical and scanning electron microscopes, electron backscatter diffraction) that between the reflector material and the porous sample itself this boundary has a thickness of $\approx$ 10–20 μm. Within this zone intense structural, chemical and mechanical changes in both parts (reflector and sample itself) takes place. This concerns precompacted mixtures of different powdered materials too. The thickness of this area where an EoS lying between the reflector EoS and the sample EoS can be applied is nearly material independent. Because of the thickness of the boundary zone in the micrometer region, versatile impact for the compaction of powders with small grain sizes can be expected.

[1] Davison L 2008 *Fundamentals of Shock Wave Propagation in Solids* Shock Wave and High Pressure Phenomena (Heidelberg Berlin: Springer)