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A penalization method for DNS of weakly compressible reacting gas-solid flows[1] BAPTISTE HARDY, JURAY DE WILDE, GREGOIRE WINCKELMANS, Universite catholique de Louvain — Gas-solid flows are encountered in many environmental and industrial phenomena. Simulating such flows at large scales requires closure models for interfacial mass, momentum and heat transfer. Particle-resolved simulations can support the development of improved closure laws, from first principles. The present study combines a penalization method to account for the solid phase with a weakly compressible approximation for the gas phase. Strong thermal effects from chemical reactions in the solid phase can induce significant density gradients near the particles and affect interfacial transfer laws. The present methodology handles general boundary conditions for the scalars: Dirichlet (Neumann) for infinitely fast (finite rate) surface reactions, and coupled heat and mass transfer description between the solid and fluid phases. A comparison with the incompressible case is also made to quantify the impact of density gradients.

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