18.16 **Numerical simulation of oil shale and shale oil ash mixing and motion in a horizontal rotary kiln**

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With soaring international fuel prices, oil shale resources represent a potential supplement to existing crude oil supplies that has widespread appeal. Solid heat carrier methods for pyrolysis of oil shale have been recognized as very effective approaches for oil shale processing. Heat transfer between the preheated shale and the hot shale oil ash depends on the mixing of the solids. Therefore, research into the mixing process for oil shale and shale oil ash is needed. The discrete element method (DEM) was employed in this work to establish a motion model in a horizontal rotary kiln and a Hertz-Mindlin model was developed to compute contact forces. The goals of this research were to assess the effect of mixing conditions and the impact of particle size in different kiln configurations (right-angled flights, straight flights and 120° angled flights). Emphasis is placed on the influence of flight forms on mixing by introducing the number of contacts between oil shale and shale oil ash to track the progress of the mixing process and taking the contact number to measure the degree of mixing. It was found that the mixing time required to reach steady-state becomes shorter in rotary kiln with flights installed compare with to those without flights. Optimal mixing conditions were achieved with 120° angled flights.