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Applications of Fast Neutron Radiography to Fluid Flow and Tumbling Media

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This investigation highlights the use of fast neutron radiography (FNR) as a technique to determine the intrinsic properties of dynamic media.
The inherent property of sand, the hydraulic conductivity, is determined using the constant head method. Through the attenuation of the fast neutrons by water, we see the evolution of the water front with time and determine important parameters from the radiographs. These parameters are employed into Darcy's law and Gardner's equation for the calculation of the hydraulic conductivity which shows how fast neutron radiography can yield unique information of the live process of water absorption through sand.
The high penetrability of fast neutrons is also used to determine the steady state of dynamic flow of grinding media within a tumbling mill. Tumbling mills are a pivotal part of the communition process, enabling one to increase the surface area of materials as well as releasing entrapped materials from the crush casing. The shape of the internal mill charge during its dynamic flow can be used to calculate important mill parameters, which are used to infer the optimal speed for the best communition of the mill charge. Key aspects of the motion of the mill charge in a rotation phase, help one obtain the optimal rotation speed required for maximum communition. Fast neutron radiography (FNR) is used to obtain the parameters related to the best grinding conditions

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