



Linking acoustic emissions and pressure fluctuations with interfacial jumps during fluid displacement in porous media

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The dynamics of fluid displacement processes such as imbibition and drainage in porous media are of considerable interest for environmental engineering and porous media research. Interfacial jumps and pressure bursts routinely occur during such fluid front displacement processes in which a part of the energy released is detectable as acoustic emission (AE). Systematic measurements have shown differences in the characteristics of AE as related to changes in pore size, liquid properties, and displacement process. Determining the exact nature of the AE-generating processes remains a challenge. The study focuses on pore scale processes occurring during fluid front passage in well-controlled spaces formed by sintered glass beads. Acoustic emission data and pressure signals were recorded during controlled injection or withdrawal of fluid and concurrent images of the interfaces were obtained using a high-speed camera. The rise and fall of pressure signals corresponded very well with the pinning and release of interfaces at the displacement front. Acoustic emissions emanate from various sources and not only from rapid emptying or filling of pores. Direct comparison of measured pressure, AE, and imaging provide information for modeling these complex displacement processes and sources of acoustic emissions.