Fractal approach in petrology: combining ultra small angle, small angle and intermediate angle neutron scattering


Ultra small angle neutron scattering (USANS) instruments have recently covered the gap between the size resolution available with conventional intermediate angle neutron scattering and small angle neutron scattering (SANS) instruments on one side and optical microscopy on the other side. New fields of investigations are now open and important areas of material science (ceramics, glass fibers, natural materials) and fundamental physics (phase transition, phase separation and critical phenomena) can be studied in bulk samples with an accuracy previously unobtainable owing to a combination of favourable features of the neutron-matter interaction: high penetrability of neutrons, even cold neutrons, ability to easily manipulate local scattering amplitudes by means of isotopic substitution methods, small absorption for most nuclei and hardly any radiation damage. In particular, neutrons see rocks as two-phase systems, and therefore the data analysis is enormously simplified. Rocks showing fractal behavior in over two decades of momentum transfer and seven orders of magnitude of intensity are examined and fractal parameters are extracted from the combined USANS, SANS and intermediate angle neutron scattering curves.

Small-angle and ultra-small-angle neutron scattering (SANS and USANS) measurements were performed on samples from the Triassic Montney tight gas reservoir in Western Canada in order to determine the applicability of these techniques for characterizing the full pore size spectrum and to gain insight into the nature of the pore structure and its control on permeability. Fractal approach in petrology: combining USANS, SANS and IANS. Article. Full-text available. Small-angle neutron scattering (SANS) is an experimental technique that uses elastic neutron scattering at small scattering angles to investigate the structure of various substances at a mesoscopic scale of about 1 & 100 nm. Small angle neutron scattering is in many respects very similar to small-angle X-ray scattering (SAXS); both techniques are jointly referred to as small-angle scattering (SAS). Advantages of SANS over SAXS are its sensitivity to light elements, the possibility of isotope labelling.