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# X-ray CT based pore-scale simulation of the electric current in porous rocks

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The electric/electromagnetic geophysical exploration is a promising method for the monitoring of the $CO_2$injected into the water-saturated aquifer. The method is based on the high resistivity of $CO_2$fluid against the low resistivity of water. The three-dimensional (3-D) microscopic distribution of $CO_2$/water in the complex pore geometry governs the macroscopic formation factor (normalized resistivity) data obtained by the geophysical exploration. However, the detail of how the microscopic status governs the macroscopic property is not elucidated completely because the electric resistivity of the porous media saturated with two-phase fluid is highly structure-sensitive, difficult to treat theoretically. We are approaching this problem by the X-ray CT based computer simulations. High resolution 3-D pore images of porous sandstones were acquired by X-ray CT. Steady-state electric currents were simulated on the porous media digital images to calculate the formation factor. A high performance computing system using GPU is being constructed. We have simulated a preliminary case of a water-saturated porous sandstone system without $CO_2$. The results show interesting nature of the local current heterogeneity such as bottle neck, possibly governs the macroscopic formation factor of the rock sample.

Keywords: CCS, geophysical exploration, simulation, electric conductivity, X-ray CT, formation factor