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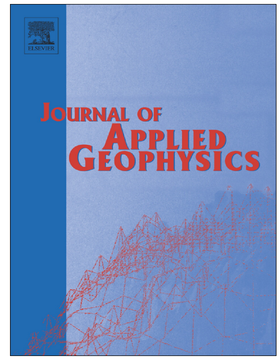

An improved dual-porosity model for the electrical analysis of fractured porous media based on the pore scale method

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An improved dual-porosity model for the electrical analysis of fractured porous media based on the pore scale method

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Abstract

The electrical resistivity of fractured rocks as a double-porosity system including matrix pore and fracture has been investigated by porosity models based on the parallel-circuit configurations of pore space. These existing porosity models only consider the electrical resistivity of the fracture and matrix. However, the matrix-fracture electrical current flow exchange is not considered, and hence, a coupling term was introduced into the existing dual porosity model. Fractured pore-scale models were reconstructed by taking matrix porous models as the host media and taking fracture models as insertions. The electrical conductivity was numerically simulated by finite element method and theoretically calculated by three existing dual porosity models. Comparison of the numerical formation factors with theoretical values proves that the theoretical dual porosity models failed to predict the true formation factors for certain combinations of matrix pore and fracture, especially for total porosity less than 15 % and fracture porosity less than 2 %. The main contribution lies in the introduction of a term accounting for the matrix-fracture electrical current flow exchange into the porosity model and discussion of the lower and upper bounds of the total porosities for different fracture porosities to consider this term. The coupling term was empirically determined by least square fitting method, and the new model better matched the formation factors of cores. Therefore,