

Abstract Submitted
for the DFD13 Meeting of
The American Physical Society

Stretching, Coalescence and Mixing in Porous Media TANGUY LE BORGNE, University of Rennes 1, CNRS UMR 6118, France, MARCO DENTZ, CSIC, IDAEA, Barcelona, Spain, EMMANUEL VILLERMAUX, Aix Marseille Université — We study scalar mixing in heterogeneous conductivity fields, whose structural disorder varies from weak to strong. A range of stretching regimes is observed depending on the level of structural heterogeneity, measured by the log-conductivity field variance. We propose a unified framework to quantify the overall concentration distribution predicting its shape and rate of deformation as it progresses towards uniformity in the medium. The scalar mixture is represented by a set of stretched lamellae whose rate of diffusive smoothing is locally enhanced by kinematic stretching. Overlap between the lamellae is enforced by confinement of the scalar line support within the dispersion area. Based on these elementary processes, we derive analytical expressions for the concentration distribution, resulting from the interplay between stretching, diffusion and random overlaps, holding for all field heterogeneities, residence times, and Peclet numbers.

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Date submitted: 26 Jul 2013

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