

EGU21-3851, updated on 13 Aug 2022

<https://doi.org/10.5194/egusphere-egu21-3851>

EGU General Assembly 2021

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Extraction of Nonlinear Dynamics of Heterogeneous Reactions Based on Sparse Modeling

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Heterogeneous reactions are chemical reactions with conjugation of multiple phases, and they have the intrinsic nonlinearity of their dynamics caused by the effect of surface area between different phases. In earth science, it is important to understand heterogeneous reactions in order to figure out the dynamics of rock formation near surface of the earth. We employ sparse modeling algorithm and sequential Monte Carlo algorithm to partial observation problem, in order to simultaneously extract substantial reaction terms and surface models from a number of candidates. Using our proposed method, we show that heterogeneous reactions can be estimated successfully from noisy observable data under conditions that the number of observed variables is less than that of hidden variables.