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Avalanches and crackling noise

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Radiation damage processes generate acoustic emission (AE) due to defect avalanches. Avalanche processes have been heavily researched (review Salje and Dahmen, 2014) in recent years. The initiation of avalanches is achieved by standing acoustic waves (Baro et al. 2013), stress, strain, electric fields and were demonstrated to be reproduced by computer simulations (Salje et al. 2017). Internal radiation damage in zircon produces avalanches with fixed numbers of displaced atoms per avalanche. The scale invariant avalanche mechanism is hence replaced by scaled single events and their overlap. The predicted transition from power law dynamics to exponential dynamics has not been observed experimentally, however, because the internal stimulus by alpha decay is too weak to generate large enough avalanche processes. Alternatively, heavy ion irradiation is expected to initiate similar responses, which can be used to study the dynamic response to radiation damage in crystalline matrices.

Baro et al.2013 Statistical Similarity between the Compression of a Porous Material and Earthquakes PRL 110, 088702.

Salje and Dahmen 2014 Crackling Noise in Disordered Materials Ann Rev CM Physics 5,233

Salje et al.Ultrafast Switching in Avalanche-Driven Ferroelectrics by Supersonic Kink Movements Adv Func. Mat.27,1700367

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