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On the Simulation of the Coating Flaking Off

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Most varnishes, paints and coatings have the drawback of flaking and peeling off, by propagating of a crack at the interface, from an initial micro- or macroscopic defect, when the substrate is deformed, for instance, by thermal expansion. We propose a simple theoretical and experimental model to explain this phenomenon. The experimental model is made of two superimposed rubber strips, in adhesive contact under the alone action of van der Waals forces, neither additional adhesive nor pre-stresses, one of them being submitted to an instantaneous elongation or to a constant speed of strain. The detachment of the other strip, that represents the spontaneous peeling and flaking off of a varnish layer, is measured and analysed using concepts of the fracture mechanics, such as the strain energy release rate, in order to determine the conditions of stability and of propagation of a crack at the interface. The main aim of this study is to draw the master curve representing the variation of the dissipation function versus the crack propagation speed at the interface. Knowledge of this dissipation function, which varies as the power 0.55 of the crack speed for the rubber-like material used, makes it possible to predict the kinetics of propagation in all particular cases, provided that elongations are purely elastic (with viscoelastic losses being left localized at the crack tip) and that the peeling results from the rupture of an adhesive joint, i.e. with propagation at the interface.

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