Vibrated Layers of Slender Fibers

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One of many solutions for thermal insulation of houses is blowing wool, where glass wool fibers are blown on the ground of a room (typically in the loft of houses). Best insulation performances are obtained for homogeneous deposits, the blowing of wool must thus be done in controlled conditions.

In this work, we study the stability of a homogeneous layer of slender fibers of centimetric length subjected to vertical vibrations. For thick fibers with a low aspect ratio, under certain vibration conditions, a flat fiber deposit can change shape and undulate (figure 1. a)). However, when the vibration stops, the deposit recovers its initial shape. Interestingly, thinner, higher aspect ratio fibers can easily entangle ; vibrated layers of such objects may thus become strongly inhomogeneous. Depending on the experimental conditions, deposits also undulate, but in some cases they can even fragment into small sub-units that we call 'hairballs' (figure 1. b)). We investigate the conditions for appearance and the stability of these hairballs, along with their characteristics.

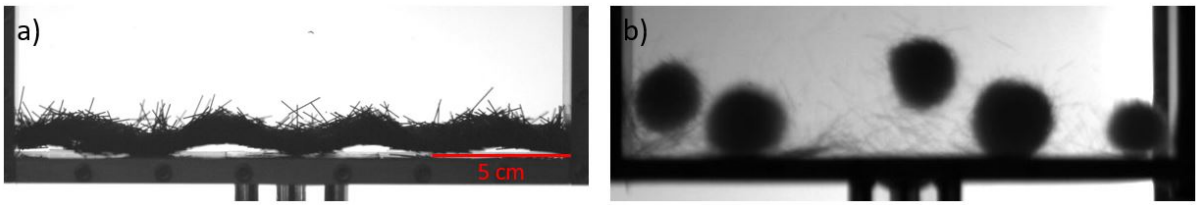

Figure 1. a) A deposit of low aspect ratio fibers (25) subjected to a vibration of frequency 20 Hz and amplitude 2 mm undulates. b) Hairballs that have formed from a deposit of high aspect ratio fibers (100) subjected to a vibration of frequency 15 Hz and amplitude 6 mm.