An explanation of transport-limited and surface-reaction-limited crystal growth

During floods, people are often observed building walls of sandbags to stop the water. Various logistical constraints often require that the bags of sand be moved by hand, and lines of people are formed to pass the bags along from one person to the next, until the bags reach the person building the wall of sandbags.

If the person building the wall works quickly, the people passing bags can't move bags quickly enough to keep him or her occupied. This is transport control or transport-limited growth: the transport process delays construction of the wall, and so transport is the rate-limiting step. In his or her desire to build the wall quickly, the builder may not only take bags from the nth person but may also move up the line to the (n-1)th person or even the (n-2)th person, grabbing their bags and putting them on the wall. The concentration of bags near the wall is thus lessened (Case a below).

If the person building the wall works slowly, each of the n persons in the line will be holding a bag, waiting to pass their bag along once the nth person has given his or her bag to the builder. This is surface-reaction control: the rate-limiting step is the placement of bags on the wall, and the concentration of bags is uniform along the line (Case b below).

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