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Melt stability and fiberizing window of stone wool compositions

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Abstract

To determine the fiberizing window of a glass melt, it is important to know the melt stability (MS), i.e., the stability of a melt against crystallization during cooling. The MS regime of a melt refers to the supercooled liquid range T_l- T_c', where T_l is the liquidus temperature and T_c' is the onset temperature of crystallization during cooling at a given rate. In the fiber production line, fiberization of a glass-forming melt usually takes place slightly above its liquidus temperature. In this paper, we show that T_c' could be used as the lower temperature limit for fiberizing processes. We establish a link between melts stability and melt spinnablity, by which the fiberizing window of several stone wool compositions can be determined based on the viscosity-temperature relationship and the MS data. The fiberizing window is much wider compared to that determined by the traditional way. We propose a spinnablity parameter (K_Y) for describing the fiber spinnablity. Furthermore we clarify the correlation between K_Y and melt fragility for several series of stone wool compositions. K_Y of each series of these compositions is inversely correlated with melt fragility and in general K_Y decreases with an increase of melt fragility. We have found an empirical constant ratio between T_c' and T_l for the studied compositions.