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WHY CERTAIN GLASS FORMING LIQUIDS "NEVER" CRYSTALLIZE?

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Understanding the conditions that favour crystallisation and vitrification has been a longstanding scientific endeavour. Here we demonstrate that the extremely high glass-forming ability of unseeded supercooled $Na_2O{\cdot}Al_2O_3{\cdot}6SiO_2$ (Albite) and B_2O_3– known for decades as "crystallization anomaly"–is caused by **insufficient crystal nucleation**. The predicted temperatures of the maximum homogeneous nucleation rates are located well below their glass transition temperatures (T_g), in a region of very high viscosity, which leads to extremely long nucleation time-lags and low nucleation rates. This behaviour is due to the remarkably small supercoolings where the glass transition occurs for these liquids, which correspond to a very small driving force for crystallization at and above the T_g, where crystallisation is normally observed. This meagre nucleation ability is caused by the **significant difference in the structures** of the supercooled liquids and their isochemical crystals. These findings elucidate the cause behind the crystallization anomaly, and could be used for the design of other oxide (and also perhaps metallic and organic?) glasses that are extremely stable against crystallization.