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Low temperature internal friction of amorphous silicon[1] XIAO LIU, THOMAS METCALF, GLENN JERNIGAN, Naval Research Lab, BATTOGTOKH JUGDERSUREN, Sotera Defense Solutions Inc., BRIAN KEARNEY, NRC Postdoctoral Associate, JAMES CULBERSTON, Naval Research Lab — The ubiquitous low-energy excitations, known as two-level tunnelling systems (TLS), are one of the universal phenomena of amorphous solids. These excitations dominate the acoustic, dielectric, and thermal properties of structurally disordered solids. Using the double-paddle oscillator internal friction measurement technique, we have shown that TLS can be made to almost completely disappear in e-beam deposited amorphous silicon (a-Si) as the growth temperature increased to 400C. However, there is a mysterious broad maximum in internal friction at 2-3K, which we suspect to come from metallic contamination of our oscillators and is not related to a-Si. Our new result of a-Si, deposited in a different UHV system and on oscillators with a different type of metallic electrodes, confirms our suspicion. This lowers the upper bound of possible TLS content in a-Si, in terms of tunnelling strength, to below 10^{-6}. Our results offer an encouraging opportunity to use growth temperature to improve the structure order of amorphous thin films and to develop high quality amorphous dielectrics for applications, such as in modern quantum devices.

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