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Characterization of the temperature dependence of dielectric loss at microwave frequencies in Al_2O_3 and TiO_2 films grown by atomic layer deposition MARTIN OTTO, CHUNQING DENG, JEAN-LUC ORGIAZZI, ADRIAN LUPASCU, Univ of Waterloo — Low temperature dielectric loss is one of the primary sources of decoherence in superconducting quantum bits and resonators. We performed detailed dielectric loss measurements of Al_2O_3 and TiO_2 thin films grown by atomic layer deposition in the 3-8 GHz frequency range at temperatures ranging from 36mK to 1K. The intrinsic Q-factor is extracted by measuring superconducting Niobium lumped element resonators which contain the dielectric material of thickness ranging from 30-100 nm. We find the temperature dependence of the loss tangent and resonance frequency agree with the tunnelling two-level system model. We also find a systematic dependence of the saturation voltage on temperature and film thickness. We compare the results obtained for Al_2O_3 films grown by atomic layer deposition with those grown by plasma oxidation. For these two different growth methods, we find similar values of the loss tangent despite different impurity content.

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