Kinetic Monte Carlo of transport processes in Al/AlOx/Au-layers: Impact of defects

Abstract:

Ultrathin films of alumina were investigated by a compact kMC-model. Experimental $I$-$V$-curves from Al/AlOx/Au-junctions with plasma- and thermal-grown AlOx were fitted by simulated ones. We found dominant defects at 2.3-2.5 eV below CBM for AlOx with an effective mass $m^\ast_{\text{ox}}=m_{\text{ox}}^\ast=0.35m_0$ and a barrier $E_B,\text{Al/AlOx}=2.8E_B,\text{Al/AlOx}=2.8$ eV in agreement with literature. The parameterization is extended to varying defect levels, defect densities, injection barriers, effective masses and the thickness of AlOx. Thus, dominant charge transport processes and implications on the relevance of defects are derived and AlOx parameters are specified which are detrimental for the operation of devices.

Stichworte:

Defect levels Tunneling Crystal defects Current density Effective mass

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