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Stress Relaxation Due to Dislocation Formation in Orthorhombic Ga_2O_3 Films Grown on Al_2O_3 Substrates

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Abstract. We analyze the preference of various types of misfit dislocation (MD) formation in film/substrate κ-Ga_2O_3/α-Al_2O_3 and κ-$(Al_xGa_{1-x})_2O_3$/κ-Al_2O_3 heterostructures. We consider two possibilities for variation in films growth orientation (defined by inclination angle ϑ) for these heterostructures with inclination axes about either [100] or [010] crystallographic directions. We study dependences of the critical film thickness for MD formation on the inclination angle ϑ for heterostructures under consideration. We find the presence of two special orientations (ϑ ~ 26° for [100] heterostructure, ϑ ~ 28° for [010] heterostructure, and ϑ = 90° for both inclination types) of κ-Ga_2O_3/α-Al_2O_3 heterostructures, for which the formation of MDs is energetically unfavorable. We show that formation of pure edge MDs is easier for [010] κ-$(Al_xGa_{1-x})_2O_3$/κ-Al_2O_3 heterostructures than for [100] heterostructures, and it is vice versa for mixed MDs in these heterostructures.

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