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Epitaxial Growth of Atomically Flat Yttrium Iron Garnet Thin Films on Gadolinium Gallium Garnet by Pulse Laser Deposition[1] TAO LIN, CHI TANG, JING SHI, Department of Physics and Astronomy, University of California, Riverside, CA, 92521 — Yttrium iron garnet (YIG) is a ferrimagnetic insulator which is useful for magneto-optical, microwave, and more recently spintronic devices. Pulsed laser deposition (PLD) has emerged as a preferred technique to deposit complex oxide thin films, heterostructures, and superlattices with high quality. Deposition of YIG films using PLD has been reported by several groups. The layer-by-layer growth mode has been achieved with a high laser repetition rate. No details about surface morphology were discussed. Here we report our approach to grow YIG films with thickness ranging from 10 to 100 nm on (110)- and (111)-oriented gadolinium gallium garnet (GGG) substrates. In both orientations, we have successfully grown epitaxial YIG thin films confirmed by the patterns of the reflection high-energy electron diffraction. The magnetic properties are measured by a vibrating sample magnetometer. The in-plane easy-axis coercivity is less than 1 Oe, while the perpendicular saturation field is $\sim$ 2000 Oe. For both orientations, the atomic force microscopy images show that the YIG surface is extremely flat with roughness $\sim$ 0.6Å. Flat terraces are found with the atomic step height in films with both orientations. This work paves the way to engineering anisotropy of the thin films for YIG-based magnetic devices.

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