

Introduction of pulsed laser deposition system and its applications

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Pulsed laser deposition (PLD) is a physical vapor deposition (PVD) technique: using a focused high-power pulsed laser beam a target surface of materials is ablated in an ultra-high vacuum chamber by the inserted beam in the chamber. By employing a proper substrate, a thin film is deposited on the substrate through vaporization process of plasma (plume) from the target. The film growth usually requires a background gas such as O₂, Ar, mixed gas of O₂/Ar. Variety of oxide films has been grown using PLD methods, and they PLD technique is mostly adjusted to obtain high quality crystalline (epitaxy) oxide films.

I will introduce some PLD systems that I have used to mostly grow oxide films. Compared to molecular beam epitaxy (MBE) technique, PLD has a shorter history and it has been widely used a few decades. A whole deposition system contains a deposition vacuum chamber, a high-power pulsed laser, and an optical part. Depending on experimental purposes, various complicating optional parts can be attached to the chamber, for example reflection high energy electron diffraction (RHEED), movable mask unit, etc. Laser itself has been evolved a lot to obtain stable, uniform and higher power laser beam profile. In an early stage, a solid-state laser such as yttrium-aluminum-garnet (YAG) laser. These days an excimer gas is widely used to ablate a variety target. Details and further introductions will be presented.

Like to know PLD technique itself, it is also highly important to know whether one can prove that grown film is the right film for an experimental purpose (characterization). I will introduce some methods to characterize films' properties. Further application of the PLD system will be discussed.