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Thin film gallium arsenide (GaAs) based devices have the highest energy conversion efficiency among single-junction photovoltaic technologies. However, expenses associated with traditional production methods, such as metal-organic chemical vapor deposition (MOCVD) and epitaxial liftoff techniques, have hindered the widespread use of GaAs in commercial technologies. Radio frequency (RF) magnetron sputtering could offer a lower cost alternative to these methods since it does not require expensive or toxic precursors, such as trimethyl gallium or arsine. However, little is known to date about depositing GaAs by sputtering for photovoltaic applications. This investigation focuses on identifying deposition conditions that result in highly crystalline GaAs layers on glass and single-crystal alumina substrates with controlled doping type and concentration.

Highly crystalline GaAs thin-films were deposited at high RF powers (> 400 W), high temperatures (> 400°C), and low pressures (1.1 mTorr). Crystallinity increased with temperature and RF power. As pressure increased, however, a loss of crystallinity was noted in the deposited films. At desirable deposition conditions for a high degree of crystallinity, the gallium-to-arsenic ratio was determined to deviate from stoichiometry. After determining the excess gallium was present as a metal on the film surface, a simple acid etching procedure was devised to selectively remove this metallic gallium and return the film to the stoichiometric ratio of Ga:As. An *in situ* zinc-doping procedure was then investigated to deposit crystalline, p-type films. Keeping RF power and chamber pressure constant, at 400 W and 1.1 mTorr respectively, zinc concentration in the film decreased with increasing substrate temperature. At temperatures upwards of 400°C, the zinc concentration was unmeasurable, indicating the zinc evaporated from the film before being stably incorporated. Despite variability in Hall Effect measurements, hole concentrations were within the desired range (10^{16}-10^{20} cm^{-3}) and increased with increasing zinc concentration.