Photon upconversion is a photophysical process where a material absorbs multiple, low energy photons, and emits a single higher energy photon. Upconverting nanomaterials show promise for applications such as bioimaging, sensing, targeted drug delivery, photodynamic therapy, solar, and security due to their ability to convert lower energy light such as near infrared (NIR) to higher energy, visible or UV. NaYF4 codoped with optically active trivalent lanthanides is commonly used for upconverting applications. In this materiel, a Yb3+ sensitizer is excited with 980 nm photons and the photoexcited energy is transferred to an activator ion (such as Er3+, Tm3+, Ho3+, Dy3+, Nd3+) which emits in the visible or UV. Although traditional methods such as thermal decomposition, solvothermal synthesis, and coprecipitation have been used to produce upconverting nanomaterials with high upconversion quantum yields, these methods have limitations of toxic side products, high reaction temperatures, long reaction times and poor control over the phase and morphology. Liquid-phase laser ablation is a promising alternative for nanomaterial synthesis due to its fast production, use of fewer chemicals, production of fewer byproducts, and control over the product through tuning of the laser parameters. In a typical experiment, a NaYF4:Yb3+/Er3+ target is produced through coprecipitation followed by 532 nm pulsed nanosecond laser irradiation in water. The laser induces formation of plasma plumes which expand, cool, and condense in the water to form particles. The resultant particles show strong red and green emission when excited with 980 nm light. Laser ablation improves upconversion efficiency when compared to the precursor target material. The size of the particles can be controlled by the power of laser used and use of capping agents in the liquid during laser ablation. Other laser parameters such as repetition rate, wavelength, and laser ablation duration can be manipulated to control the resultant nanoparticles.