Liquid crystal films as plasma mirrors and targets for high repetition rate secondary beam generation

Patrick Poole, Ohio State University, Columbus

Liquid crystals are a new target medium for intense laser experiment and applications that hold particular promise for next generation high repetition rate lasers. Smectic phase liquid crystals have surface tension that allows them to be formed into freely suspended films within rigid frames, and manipulating the parameters of film formation (temperature, volume, wiper speed, etc.) allows thickness variation on demand from 10 nm to over 50 µm. A device has been made that forms these extremely low vapor pressure films at rates up to 0.1 Hz within 2 µm RMS of the same position each time, bypassing the difficulty of high rep rate target alignment. Prototype devices can make films at 1 Hz scalable to 10. In addition to their utility as high rep rate solid density targets for secondary beam applications like ion acceleration, these films have sufficient reflectivity and surface quality to be used as high rep rate plasma mirrors. Initial data on tuning thickness to minimize prepulse transmission will be shown, along with results showing ion acceleration optimization through thickness manipulation.