Kα Spectroscopy And Radiation Yield Enhancement With Advanced Targets

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Abstract:
An experimental study of advanced target geometries is presented with view to x-ray yield, hot electron yield and hot electron temperature enhancement. One target family consists of guiding geometries such as pyramids and wedges that were edged into silicon substrates. Another target family consists of monolayers of wavelength-scale spheres that were laid down on silicon wavers. A versatile cylindrically curved crystal spectrometer was designed and employed to determine K-shell and Kα yields from the various targets. An array of scintillator / photomultiplier detectors was calibrated and employed to determine the bremsspectrum and the hot electron temperature.
A strong hard x-ray and Kα yield dependency was found for wedges in s- and p-polarization. The results are explained with recent 2D PIC simulations that were performed for the presented guiding geometry. It was found that spheres-coated targets enhance the Kα yield by many times. A sphere-size scan reveals a resonance-like behavior for 0.26 mu spheres.
Both target concepts are promising approaches to advanced radiation sources as required by plasma heating and x-ray probing.