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Instrumentation Development for Dynamic Atom Probe Tomography[1] BRIAN GORMAN, DAVID DIERCKS, Colorado School of Mines — Atom probe tomography (APT) is a materials characterization technique widely recognized as having the highest combined spatial (sub-nm) and chemical (less than 10^{17} atoms / cm^3) resolution. This imaging time of flight mass spectrometry technique typically utilizes laser pulsed field emission in semiconductors and dielectrics. Laser pulsed field emission is widely considered to be a thermal effect, with specimen temperatures from 100 K to greater than 1500 K observed. Following the thermal spike, specimens typically cool to their base temperature in less than 5 ns, depending upon their thermal transport and geometry. Combining the laser pulsed atom probe experiment with pulsed transmission electron diffraction will enable thermal annealing and quenching experiments at atomic resolution with nanosecond temporal resolution. The combined instrument, titled a Dynamic Atom Probe, will be used to monitor solid state processes including solute drag effects on grain boundary motion, atomic scale kinetics of crystallization in amorphous semiconductors and oxides, atomic scale nucleation and spinodal decomposition kinetics in oxides, and phase transformations in metallic alloys. This discussion will include the specifics of the instrumentation currently under development as well as proof of principle first experiments.

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