A plasma-cleaning system was acquired with $12,500.00 financial support from the ISEN program and installed in August 2010 at the Northwestern University Center for Atom-Probe Tomography (NUCAPT). The plasma cleaning system is directly connected to the specimen load-lock of the local-electrode atom-probe (LEAP) tomograph at NUCAPT and allows for transferring local electrodes and specimens seamlessly into the LEAP, without exposing them again to air, after they were plasma cleaned. Scientifically highly significant LEAP tomographic analyses with subnanometer spatial resolution in three dimensions, and a 10 at.ppm chemical analytical sensitivity benefit in two ways from the plasma cleaner: (1) where appropriate, the surface of oxidation-resistant materials can be cleaned prior to LEAP analysis, for instance for silicon and silicon-oxide based materials; (2) Local electrodes that serve as the counter-electrode during LEAP examination of the samples can be cleaned, greatly improving the quality of the LEAP tomographic results obtained; and (3) Additionally, the useful lifetime of the local electrodes is extended by a factor of two to three, which represents an energy savings since they need to be replaced less frequently.

In the year since the installation, August 2010, the plasma cleaning system has been used for approximately 600 hours for about 20-25 individual cleaning runs. Approximately 70% of the usage time was for the energy-related research projects including the ones listed below. Twenty users from seven different research groups at Northwestern and four collaborative projects with other institutions (three internationally) profited directly from the plasma cleaning system during the first year of its operation.

High-quality LEAP tomographic mass spectra obtained with plasma-cleaned local electrodes were instrumental for the following energy-related research projects at Northwestern: (1) Nanostructured Pb-Te based thermoelectric materials for energy conversion: the distribution of dopant elements and nano-scale precipitates could be revealed by LEAP tomographic measurements\(^1\); (2) coarsening-resistant light-weight Al-Sc-based alloys for transportation and aerospace applications; (3) high-performance photovoltaic materials; (4) Ni-based and Co-based high-temperature superalloy and model superalloys; (5) compositional gradients across interfaces and elemental substitution in GaSb/InAs based materials for infrared detectors; (6) Dopant atom concentrations and distributions in core-shell structured Si- and Ge based nanowires, which are promising candidates for small-scale nanoelectronics; and (7) LEAP tomographic characterization of isotopically pure silicon multilayer structures. Isotopically pure Si has different physical properties than the natural isotopic mix currently used in microelectronics, thereby offering the potential for improved performance of electronic components. This work was published in *Applied Physics Letters*\(^2\).

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\(^1\) I.D. Blum, D. Isheim, D.N. Seidman, J. He, J. Androulakis, K. Biswas, V.P. Dravid, M.G. Kanatzidis, “Dopant distributions in PbTe-based thermoelectric materials”, to appear in the proceedings of the 2011 International Conference on Thermoelectrics.