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GRADIENT COMPOSITION ALLOY NANOPARTICLE ARRAYS FOR HYDROGEN SENSING.

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Abstract text

If hydrogen fuel is to achieve its full potential as a next-generation energy carrier, safe handling of the highly flammable gas will be imperative. To this end, the development of fast, reliable, and highly sensitive hydrogen detection sensors is of utmost importance. Sensors based upon the hydride forming Pd(alloy)-H system is turning out as one of the best performing systems, but there is still a gap before the performance of these systems match targets set by stakeholders such as the US Department of Energy (DoE) [1].

Among the many varieties of sensors based on the Pd-H system, optical sensors utilizing the localized surface plasmon resonance (LSPR) of Pd alloy nanoparticles have shown great promise in reaching the performance targets [2, 3]. However, to push the performance of Pd LSPR hydrogen sensors even further, optimising the alloy composition of the nanoparticles is necessary.

As a solution to this problem, we have developed a microshutter device that can be used in combination with physical vapor deposition (PVD) for fabricating and subsequently screening multiple alloys on the *same* sample, with spatial control down to the level of the individual nanoparticle. Finally, we have applied single particle plasmonic nanospectroscopy and imaging techniques ([4]) to PdAu alloy nanoparticles fabricated with the device to demonstrate the thermodynamic and kinetic response of nanoparticles to hydrogen as a function of composition, motivated by their application in state-of-the-art plasmonic hydrogen sensors [2].

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Picture of Author	Short Biography of Author
	I'm a PhD student at the Department of Physics at Chalmers University of Technology in Gothenburg, Sweden. My research is focused on relating the microstructure of metallic nanoparticles to the thermodynamics and kinetics of hydrogen sorption, specifically with applications of hydrogen sensing in mind. To study this, I combine the results of both single particle plasmonic nanospectroscopy and electron microscopy.