

## Palladium nanoparticles on InP for hydrogen detection

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Metal layer on semiconductor form energetic barrier called Schottky barrier. On this interface, we are able to detect hydrogen molecules in air. The presence of hydrogen is detected by the change of I-V characteristics of these structures. In this work, we prepared and studied interfaces with various metals in nanoparticle form on n type InP substrates. Metals which were studied were Pd, Pt, Au, and Ag.

Nanoparticles of metals were prepared by reverse micelle technique in isooctane. In this nonpolar solvent, the metal nanoparticles are embedded in reverse micelles of surfactant AOT (bis-(2-ethylhexyl) sulfosuccinate) [1]. The size of nanoparticles was about 20 nm. From these solutions, nanoparticles were deposited onto single crystal wafer of n type InP by electrophoresis. The schematic drawing of the structure is shown on Fig.1. Two types of layers were prepared by applying both polarities of deposition. Further, the layers were annealed in high vacuum at 400°C to remove surfactant from the structure.

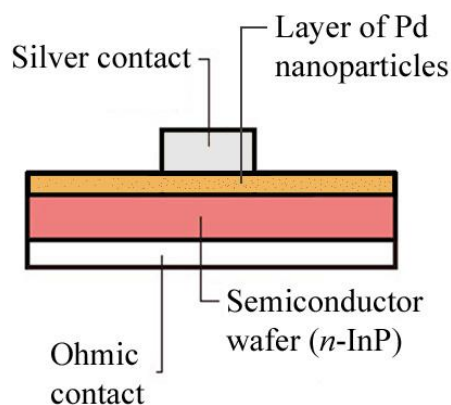
These structures were studied by current-voltage measurements, where the diodes prepared by positive potential on InP wafer showed better rectifying properties than diodes prepared by the other way. The typical current-voltage characteristics are shown on Fig.2. From current-voltage characteristics, the Schottky barrier height was calculated. For Pd/InP interfaces with positive potential on the wafer the Schottky barrier height was over 1 eV. Other methods of characterization were secondary-ion mass spectroscopy, AFM, SEM (Fig.3.), capacitance-voltage measurements, and measurements of response of the structure on the presence of hydrogen [2]. The last measurements showed that the current was about two orders of magnitude higher in the presence of hydrogen.

### References:

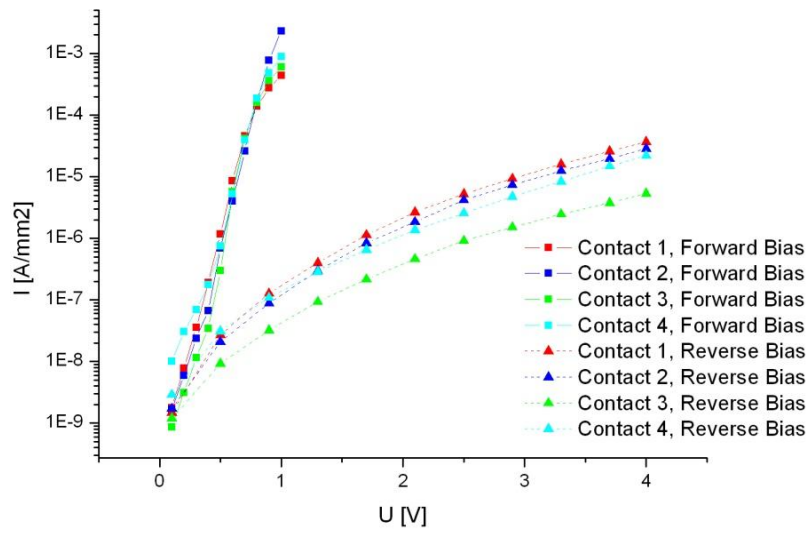
[1] CHEN D.H.; WANG Ch.Ch.; HUANG T.Ch. *Preparation of Palladium Ultrafine Particles in Reverse Micelles*. **Journal of Colloid and Interface Science**, 1999, č. 210, s. 123-129. ISSN 0021-9797/99

[2] Žďánský K., Zavadil J., Kacerovský P., Lorinčík J., Vaniš J., Kostka F., Černohorský O., Fojtík A., Reboun J., Čermák J.: *Electrophoresis deposition of metal nanoparticles with reverse micelles onto InP*, **International Journal of Materials Research**, 2009, vol. 9., p. 1234-1238, ISSN 1862-5282

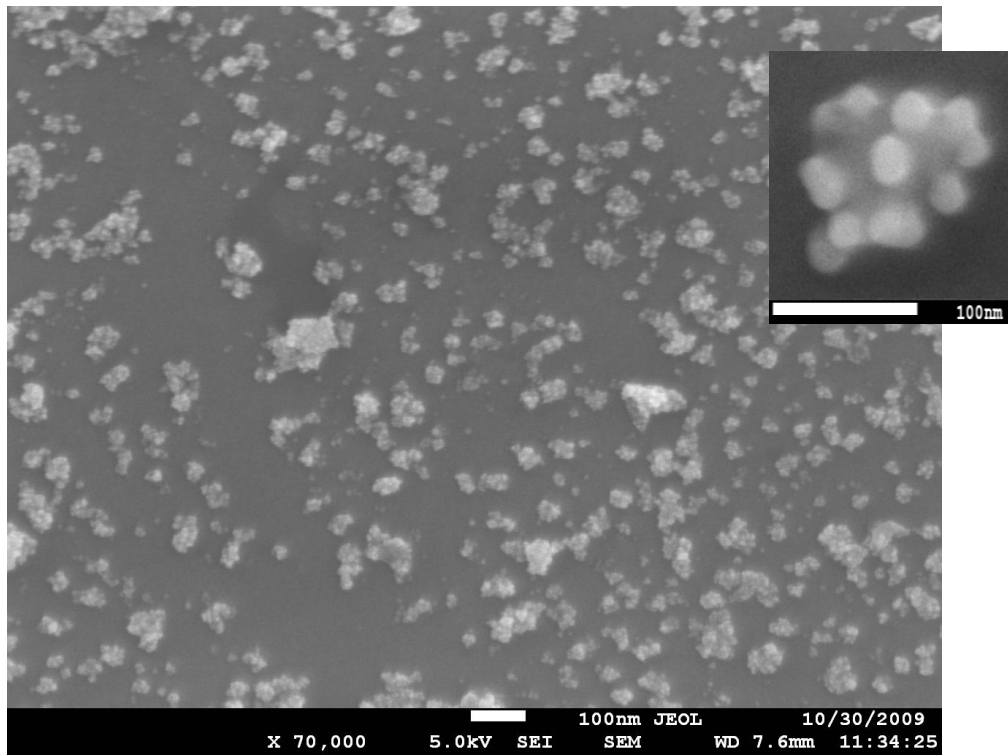
### Figures:



**Fig.1.** The schematic drawing of structure



**Fig.2.** Current-voltage characteristics of Pd/InP interface



**Fig.3.** Current-voltage characteristics of Pd/InP interface