# TEM and SEM characterization of $Pd_2Si$ nanorods

K.Sobczak[1], P. Dluzewski[1], M.T. Klepka[1], R. Diduszko[2], J. Dabrowski[1], E. Czerwosz [2]

[1] Institute of Physics, Polish Academy of Science, al. Lotników, 32/46 Warsaw, Poland
[2]Tele and Radio- Research Institute, Ratuszowa 11, 03450 Warsaw, Poland

## INTRODUCTION

**Palladium silicide is an interesting material for the use in electronic applications due to its mechanical properties and good electrical conductivity. This resulted that $Pd_2Si$ was applied as a material in contact ohm, Schottky diodes or hydrogen sensors. In this paper we presents bottom to top grow the $Pd_2Si$ nanorods obtained in the PVD/CVD process.**

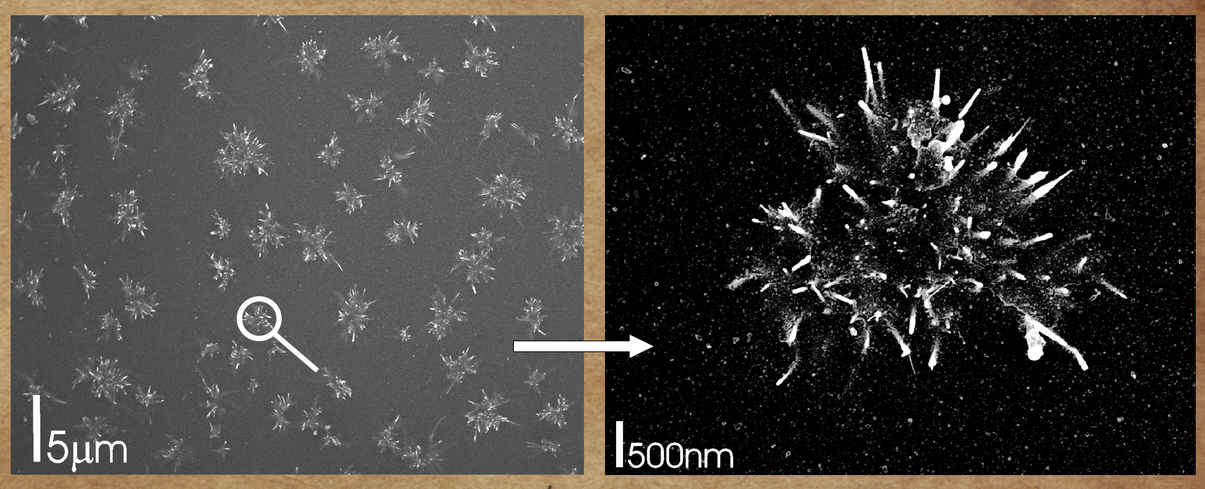


**Fig.1. SEM image of a Pd-C film and hedgehogs - like structures.**

## EXPERIMENTAL PART

**$Pd_2Si$ nanorods (NR) grown from palladium carbon films deposited on the silicon substrate. This films were prepared in two steps process with the use of physical vapor deposition (PVD) and chemical vapor deposition (CVD). In the first step, fullerenes $C_{60}$ and palladium acetate were deposited on silicon substrate in PVD process. In the second step, the obtained film was modified in CVD process at temperature of 750°C for 30 minutes in the presence of xylene.**

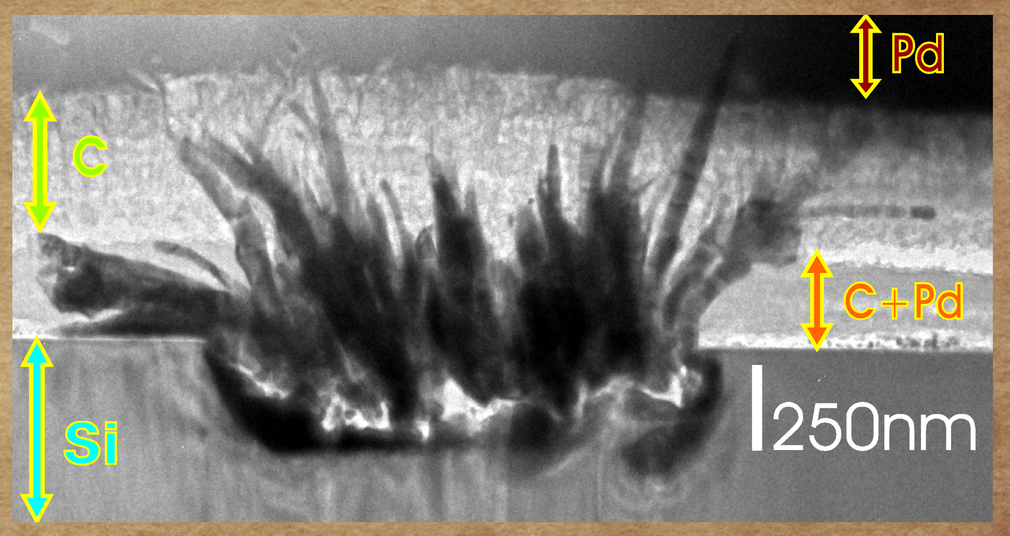


**Fig.2. TEM image of lamella of the hedgehog-like structure.**

## RESULTS

**Palladium silicide was investigated with the usage of SEM, XRD and TEM methods. SEM image of a Pd-C film and hedgehogs-like structures are shown in Fig.1. We prepared cross section of the structure used a focused ion beam (FIB). In the Fig.2 is presented the hedgehog - like structure. It is visible that NR's grow is chaotically. Distribution of elements with the usage Energy Filtering TEM measurement is presented in Fig.3. The XRD analysis showed occurrence $Pd_2Si$ (Fig. 4), which was also confirmed by electron diffraction from the single $Pd_2Si$ rod (Fig.5).**

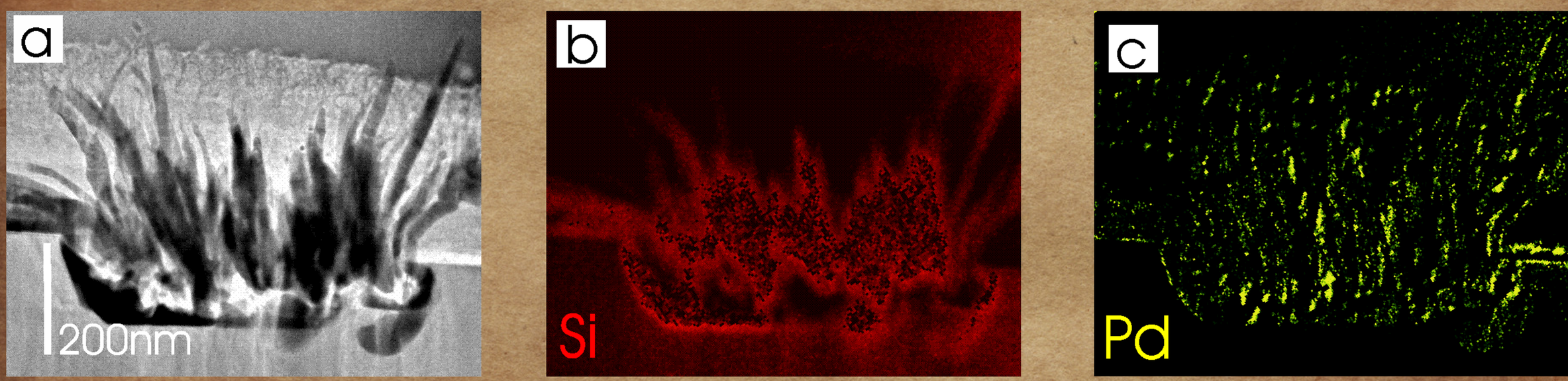


**Fig.3. a) TEM image b) Si map c) Pd map.**

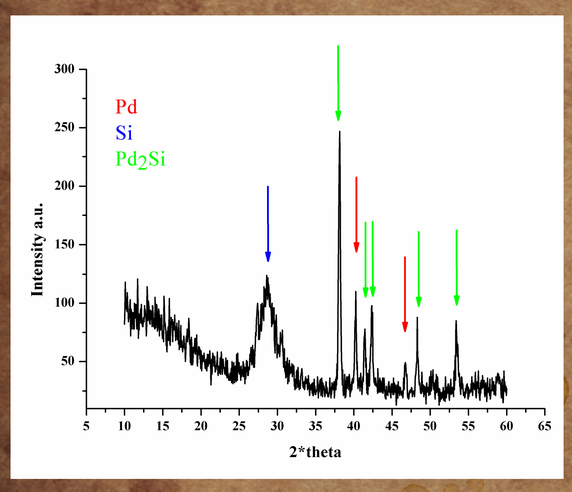


**Fig.4. XRD spectrum from Pd-C film**

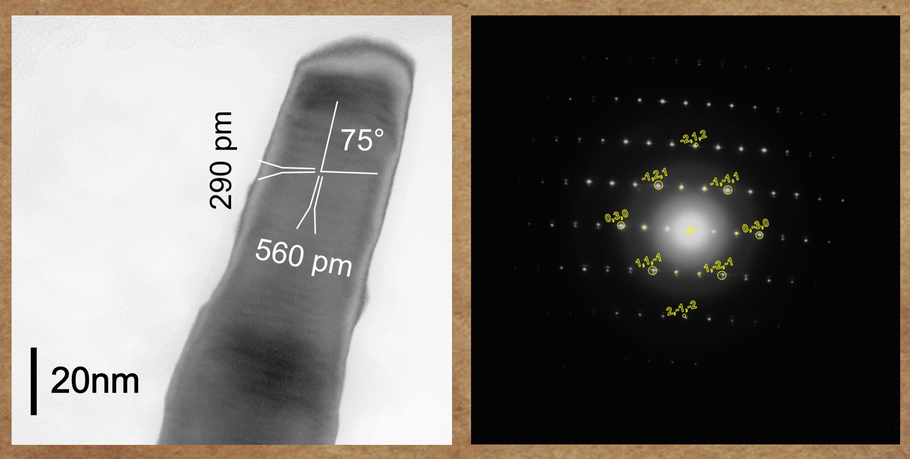


**Fig.5. TEM image of a single rod with electronogram**

## CONCLUSION

**The growth of palladium silicide is possible when two requirements are fulfilled – the temperature and the concentration of palladium crystallites. One of them is the agglomeration of palladium which is observed in the sample obtained in the PVD process. The second, is temperature – higher than 650°C, fulfilled in the CVD process.**

INNOWACYJNA GOSPODARKA
NARODOWA STRATEGIA SPÓJNOŚCI

This research was co-financed by the european regional development fund within the innovative economy operational programme 2007-2013 ("development of technology for a new generation of the hydrogen and hydrogen compounds sensor for applications in above normative conditions". no uda-poig. 0103.01-14-071/08-06 and "analytical high resolution transmission electron microscope for nanoscience, nanotechnology and spintronics" no poig. 02.01-00-14-032/08.

UNIA EUROPEJSKA
EUROPEJSKI FUNDUSZ
ROZWOJU REGIONALNEGO