

UNIFORM Si/Ni JUNCTION FORMATION USING TWO STAGES ELECTROLESS Ni DEPOSITION

Authors: V. Ulbikaitė, V. Čyras, A.
Momot, L. Jaraminė, A. Selskis

2nd Euroregional Workshop on Photovoltaics EUROREG-PV 2014
1-3 September 2014 Ljubljana, Slovenia

CONTENTS

- Relevance
- Experiment
- Results
- Conclusions

RELEVANCE

- Electroless Ni and Cu plating:
 - Low price alternative to Ag paste
 - Simple equipment required - practical for mass production
 - Issues: poor adhesion and high contact resistance

EXPERIMENT

■ Process:

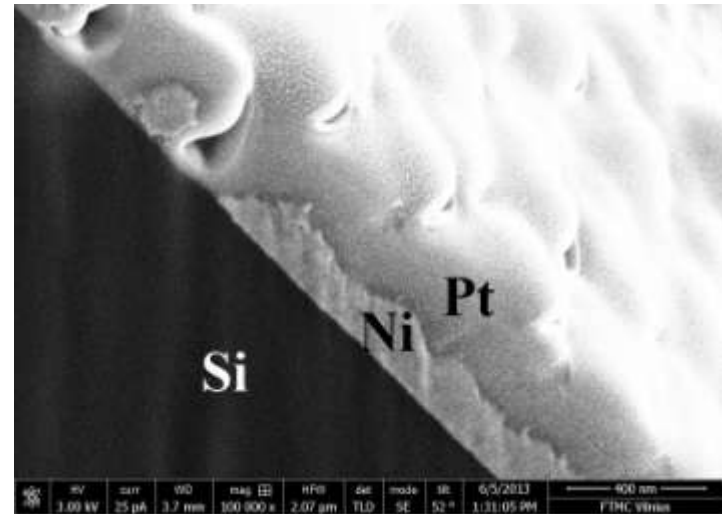
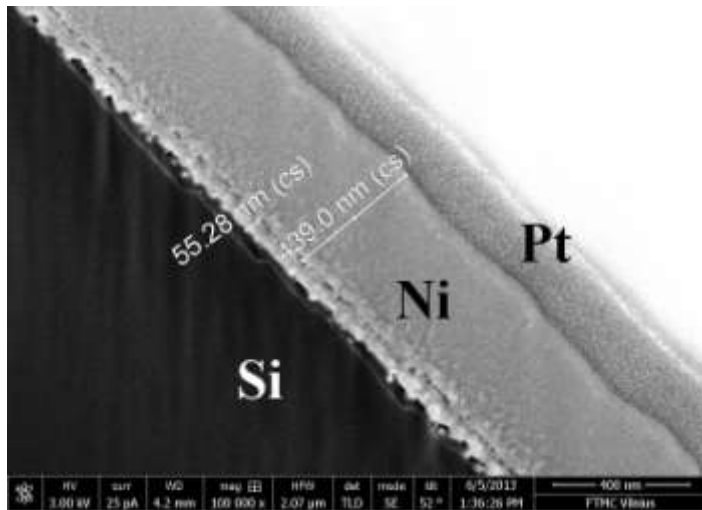
- First stage – nucleation of Ni on Si.
- Second stage – Ni deposition on nucleation sites

■ Investigation:

- One stage and Two stages metallisation of various bath combinations

	IA	IB	IIA	IIB
Ni^{2+}	1,05 mol	1,05 mol	0,11 mol	0,11 mol
$\text{NaH}_2\text{PO}_2 \cdot \text{H}_2\text{O}$			0,09 mol	0,09 mol
$(\text{NH}_4)_2\text{HC}_6\text{H}_5\text{O}_7$			0,26 mol	0,26 mol
NH_4Cl	0,83 mol	0,83 mol	0,83 mol	0,83 mol
pH	9	9	9	9
T, °C	90	90	90	90
SDS		1 mg		1 mg
NH_4F		180ml		180ml

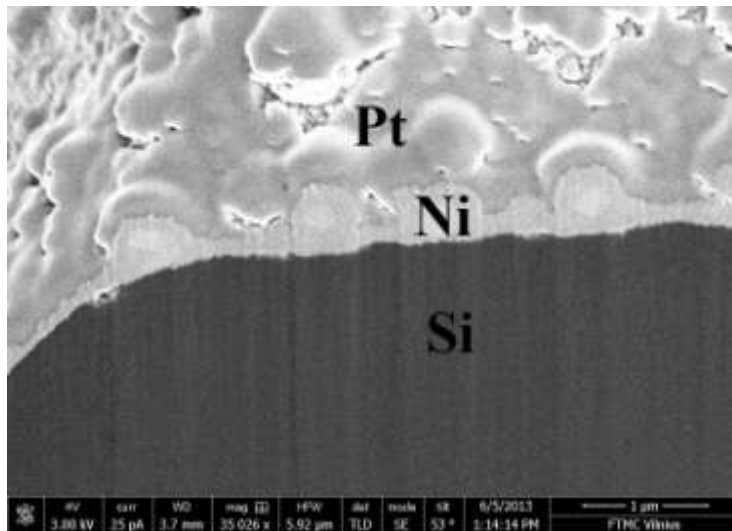
RESULTS



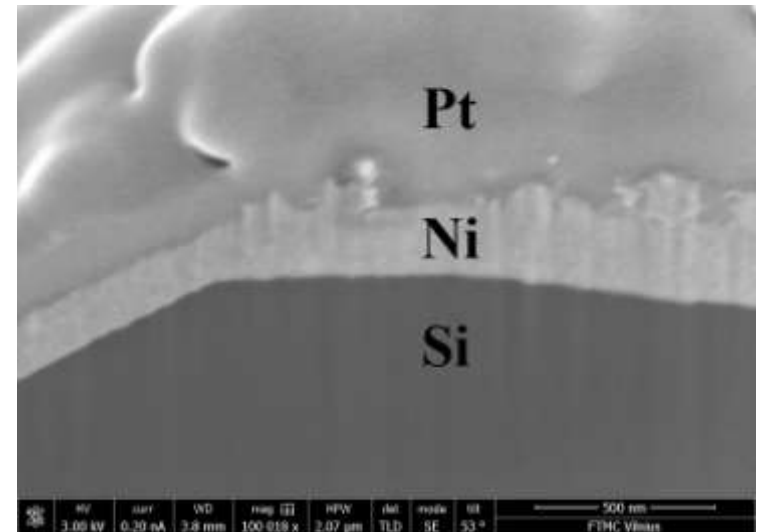
- IA+IIA
- Non-uniform Ni-Si junction, two Ni layers

- IA+IIB
- Open Si areas, non-uniform junction

RESULTS



- IB+IIA
- Non-uniform junction, highly uneven layer

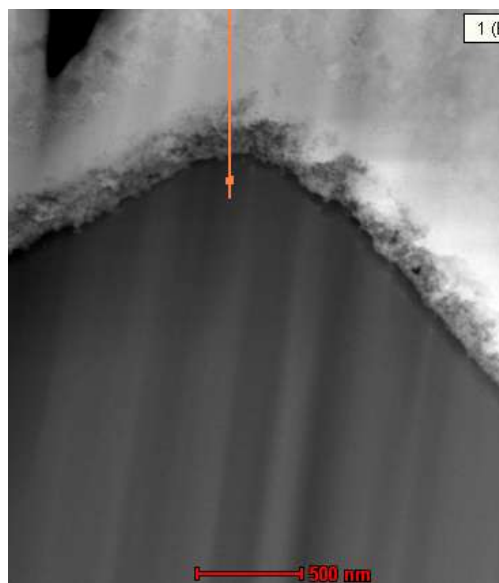


- IB+IIB
- Uniform Ni-Si junction

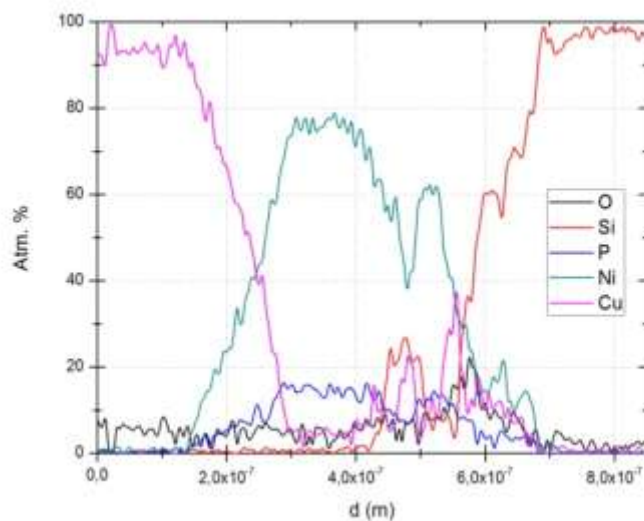
EXPERIMENT II

- Successfull bath solutions (IB+IIB) were used for further experiments:
 - Samples were annealed using RTA furnace.
 - T: 420°C
 - T: 10s, 20s.
 - Investigated using TEM

RESULTS II

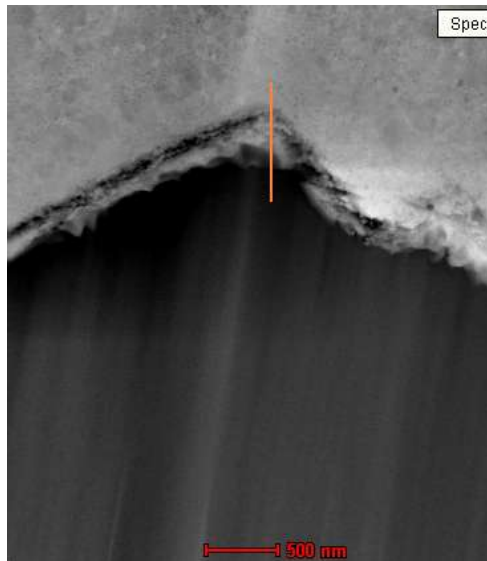


Annealing time = 10s; 6% efficiency

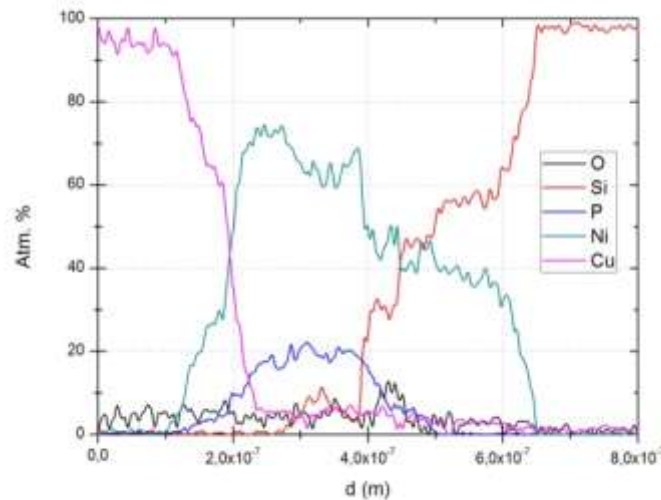


- Annealing time $t=10s$
- 250nm NiSi layers
- Sample with 6% efficiency contains 10-30% Ni in Si, and similar percentage of Si in Ni.
- Possibly form high resistance layers of various NiSi phases.

RESULTS II

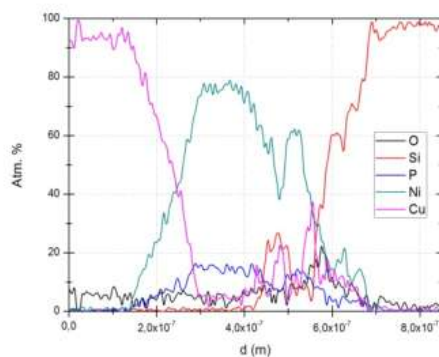
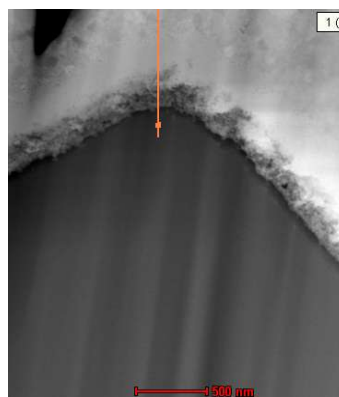


Annealing time = 20s, 14% efficiency

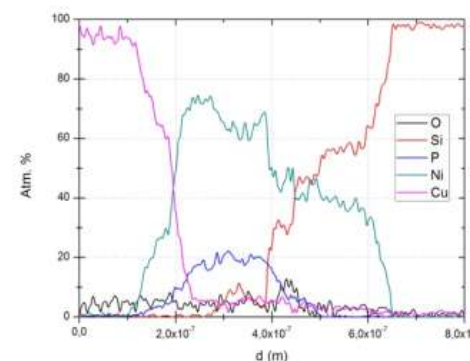
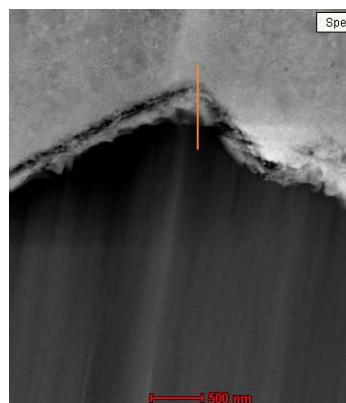


- Annealing time $t=20s$
- 250nm NiSi
- Sample with 14% efficiency contains 40-50% Ni in Si and forms NiSi junction.
- Possibly forms low resistance NiSi layer.

RESULTS II



Annealing time = 10s; 6% efficiency



Annealing time = 20s, 14% efficiency

- 6% sample contains up to 20% of O atoms in the scanned spot.
- 14% sample contains up to 10% of O atoms.

- Fill factors have been measured.
- FF(6%)= 34
- FF(14%)= 71

CONCLUSIONS

- The goal of the work was to investigate whether the technological process could be used for quality contact formation.
- The technological solution for quality contact formation is possible.
- Achieved results enables further investigation of Ni/Cu contact formation: contact stability, electrical parameters. If satisfactory, the process could be suitable for upscaling.

THANK YOU

Acknowledgements

The SOLGAIN project has received funding from the European Union's Seventh Framework Programme, managed by the European Commission under Grant Agreement No. FP7-SME-2012-315663.

