SWTEST
PROBE TODAY, FOR TOMORROW

SW Test US 2025

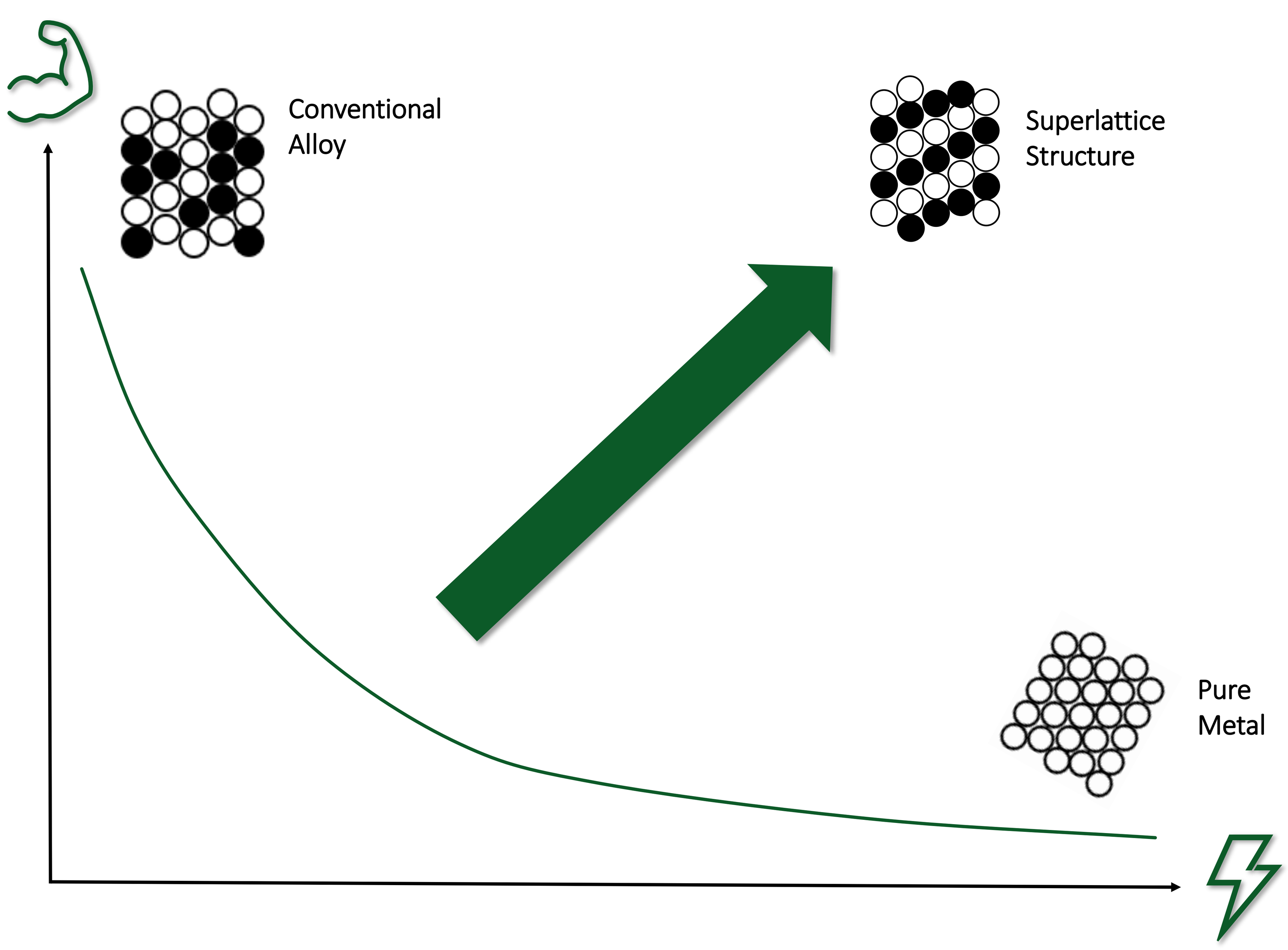
M. Wegner, N. Akrouti, J. Schuster
Heraeus Precious Metals – Functional Materials

Heraeus
Precious Metals

Palysium C+

Testing of high-performance computer chips demands specialized probe needle material solutions, capable of handling high current densities, thermal management challenges as well as mechanical property requirements. To tackle these challenges Heraeus Precious Metals developed a new alloy class – Palysium C+ – utilizing optimized order disorder transitions in Pd-Cu based alloys to form so called superlattice structures. Palysium C+ features exceptional conductivity, while maintaining very good mechanical properties which, in turn, results in a significant increase in the CCC-value compared to state-of-the-art Pd-Cu based solutions, making Palysium C+ the ideal material solution for advanced testing applications.

Background

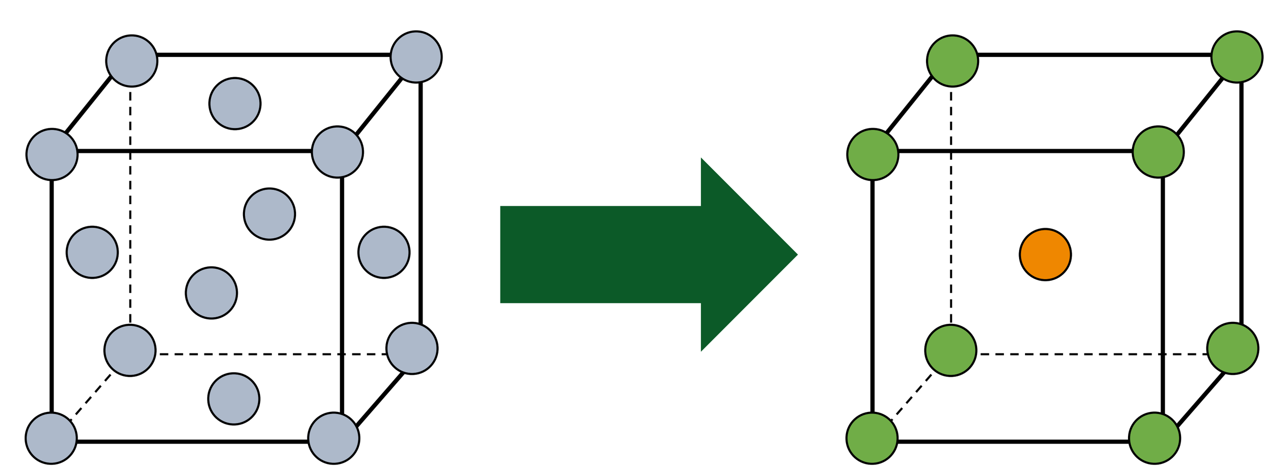


Challenge

- Strong Materials, e. g. alloys, tend to be bad conductors
- Conductive Materials, e. g. pure metals, tend to be soft

Solution

Exploitation of order / disorder transitions
➔ Formation of superlattice structures to produce conductive alloys while maintaining high strength

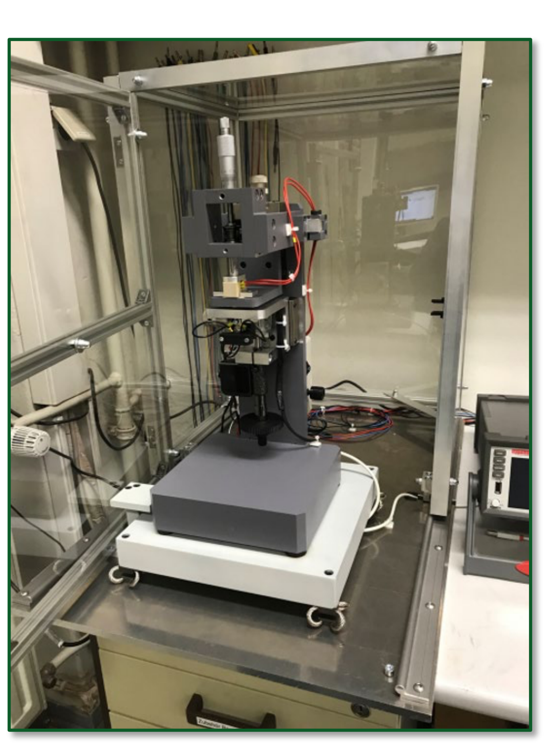


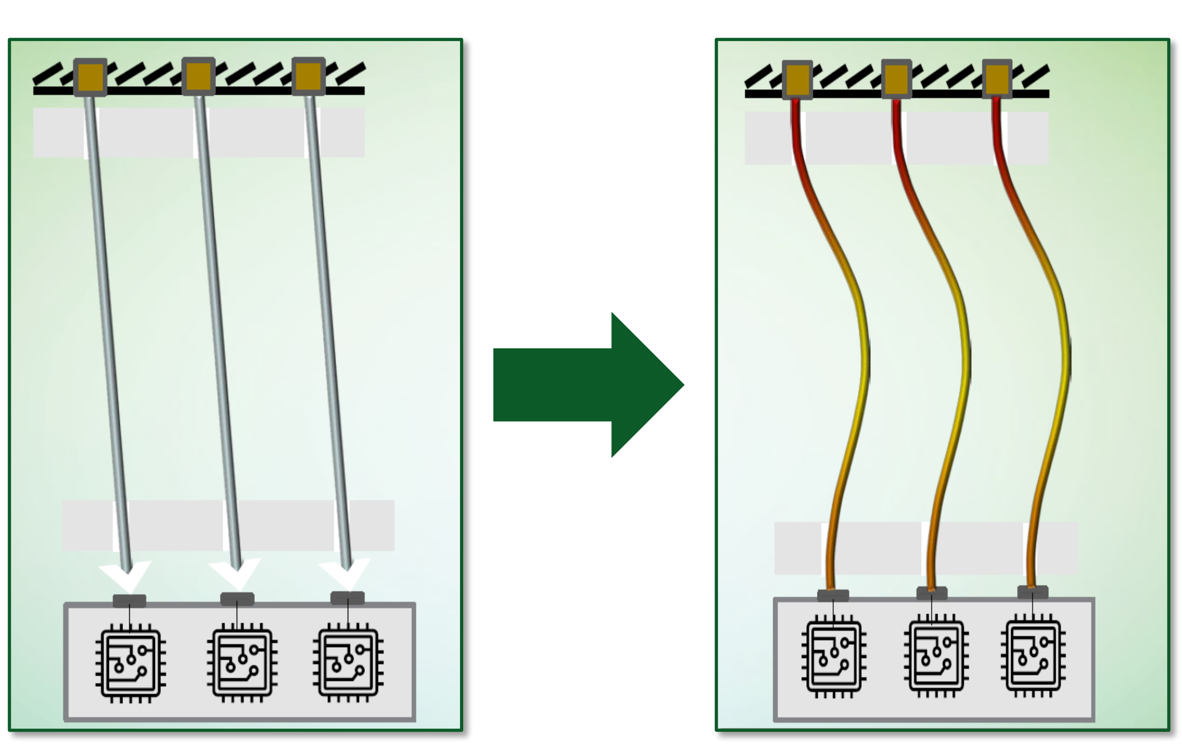
No Superlattice
FCC Structure
● Pd / Cu

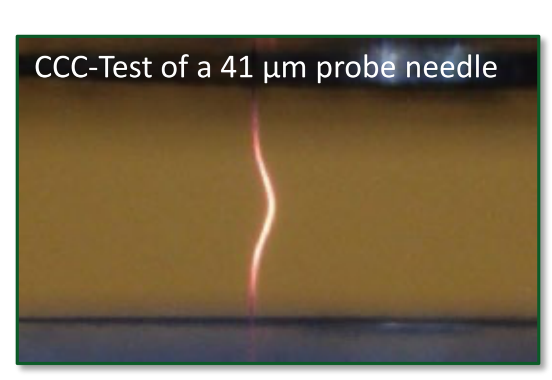
Strong e-scattering
➢Low electrical conductivity

Superlattice
B2 Structure
● Pd
● Cu

Weak e-scattering
➢High electrical conductivity







CCC-Value

Maximum current a probe needle can withstand before the contact force falls below 80% of the initial value (@ a given overdrive)

Probe Needle Performance

- Reflected in the Current Carrying Capability (CCC)
- Combination of material properties & geometry

Dr. Matthias Wegner – Heraeus Precious Metals – Functional Materials / Heraeusstraße 12-14 - 63450 Hanau – Germany / matthias.wegner@heraeus.com

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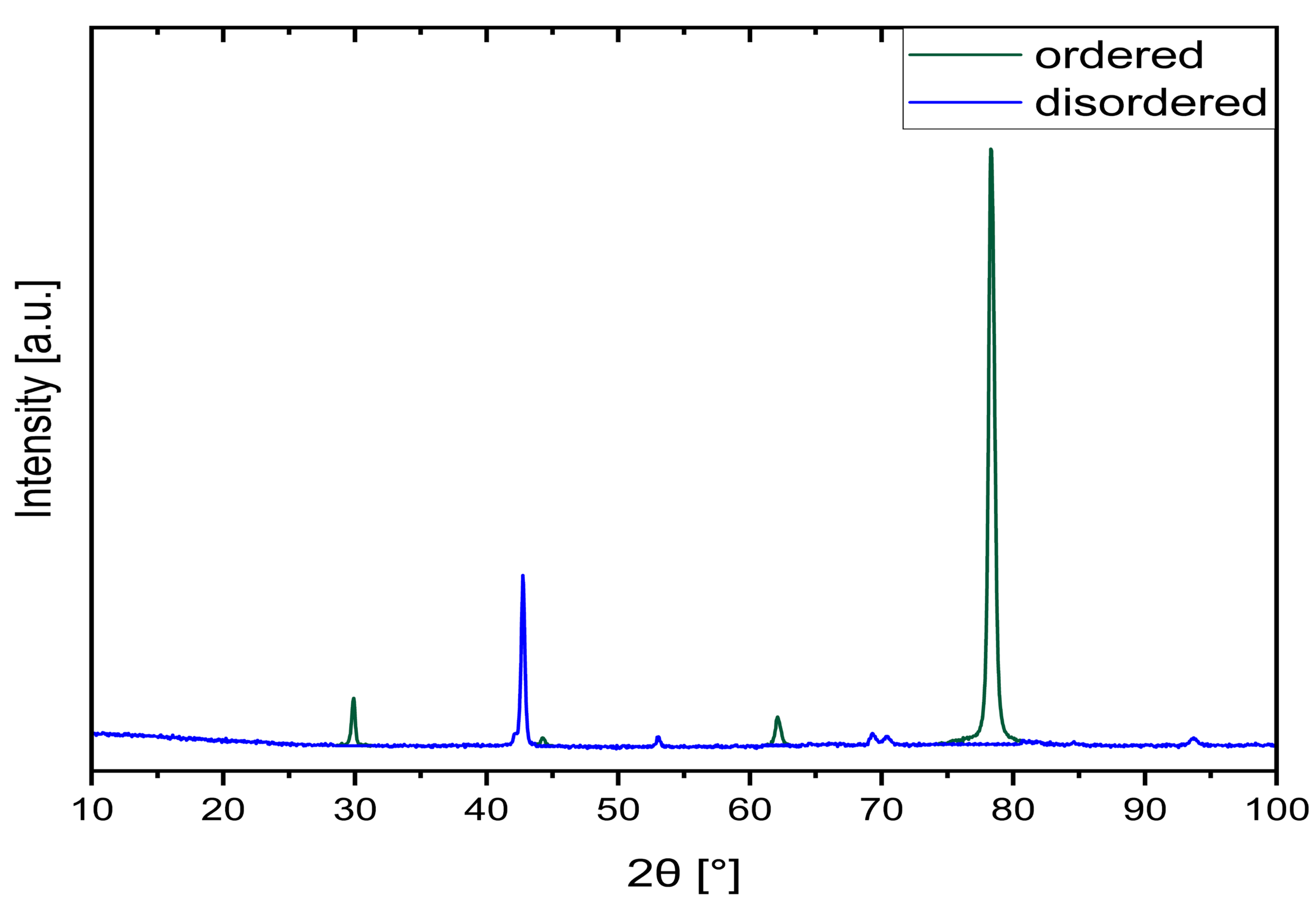
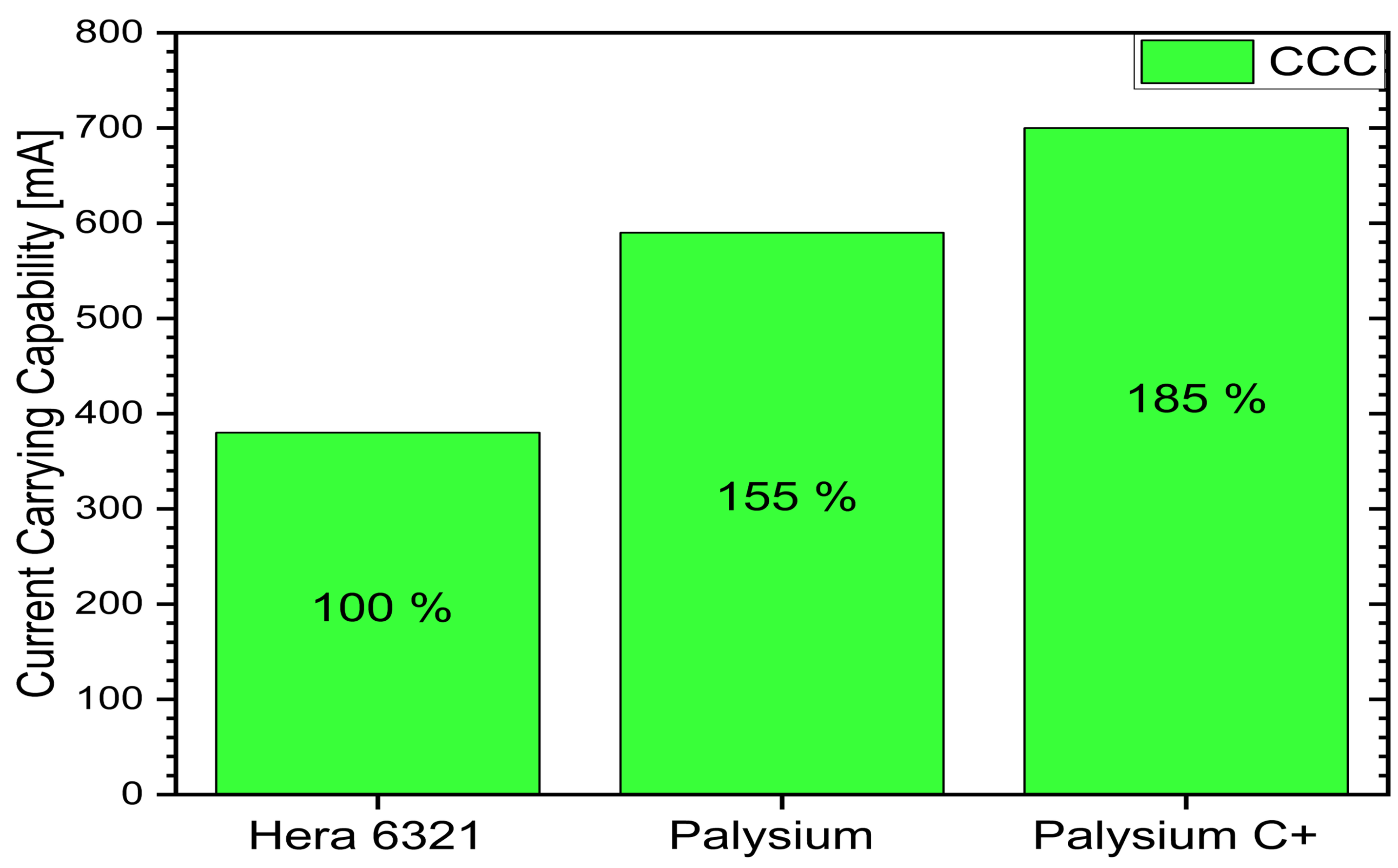
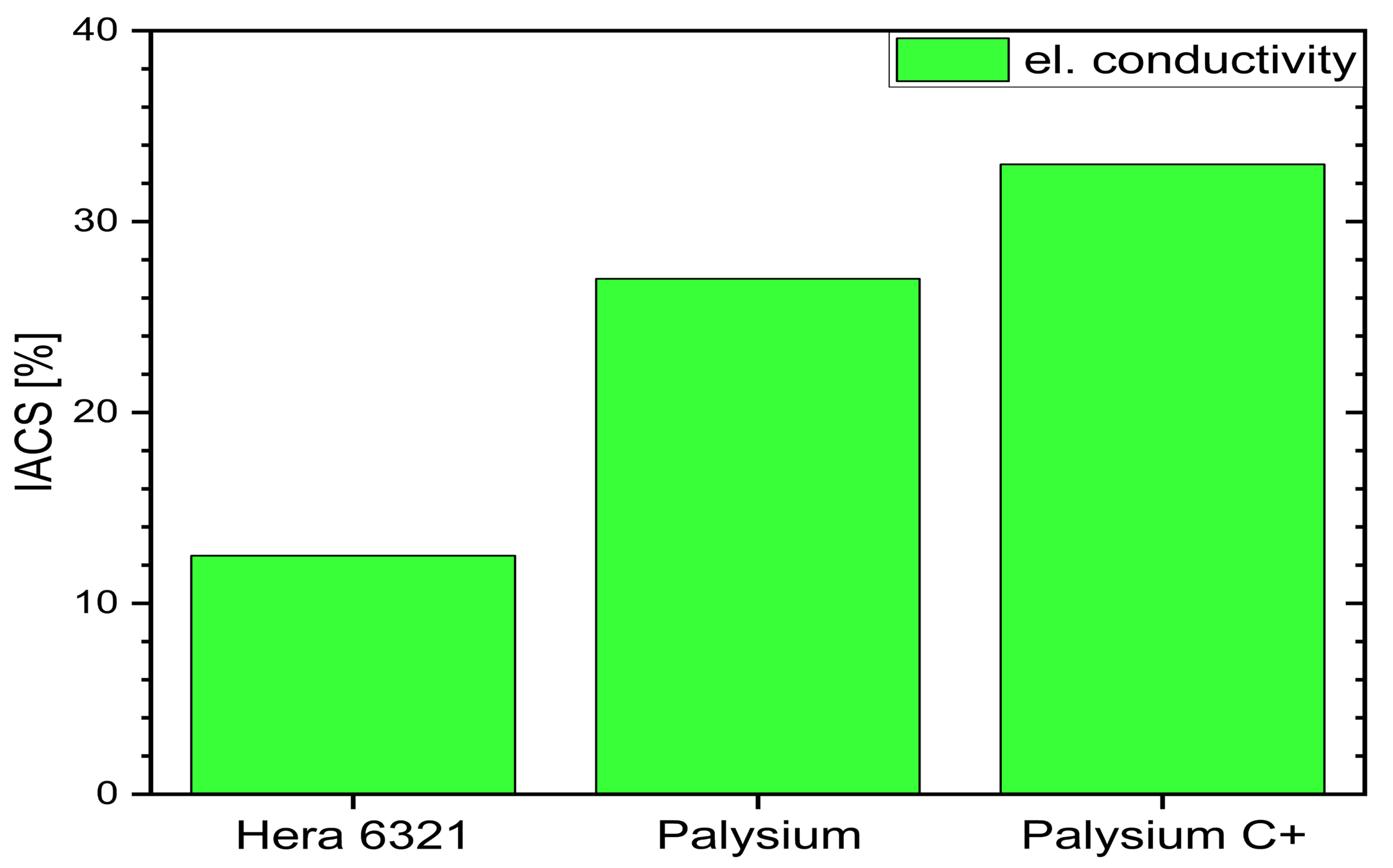
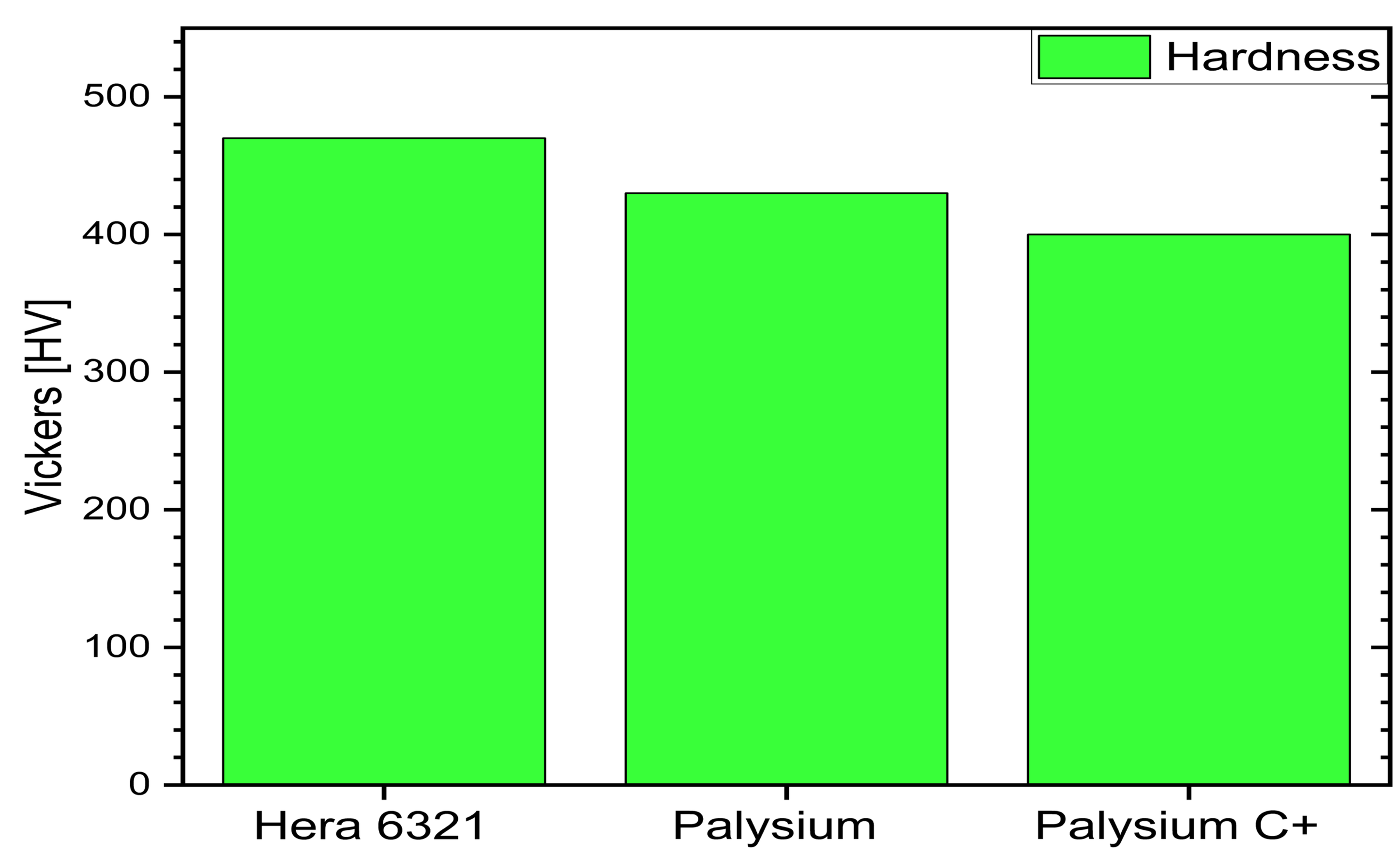
Results









Discussion

- **Palysium C+ exhibits a higher fraction of ordered phase as seen in the very pronounced B2 structure peak formation in X-Ray diffraction experiments**
- **Increasing of the fraction of ordered B2 phase is achieved via targeted alloying and optimization of the crystal & micro structure of the alloy via thermomechanical processing**
- **Showcasing increased electrical conductivity (33% IACS) compared to state of the art alloys**
- **Maintaining similar Vickers Hardness after thermomechanical processing (400 HV)**
- **Overall increase in probe material / needle performance by +20% ➔ 700 mA CCC**

(For CCC-Test details see "Conclusion")

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Conclusion

Material	Composition	Atomic Structure	IACS [%]	Hardness [HV]	CCC [mA]	CCC [%]
Hera 6321	PdCu-alloy	FCC	12,5	470	380*	100
Palysium	PdCu-alloy	Superlattice	27	430	590*	155
Palysium C+	PdCu-alloy	Improved Superlattice	33	400	700*	185

Optimization of the superlattice B2 crystal structure in a Pd-Cu alloy through modifications in elemental composition and thermomechanical processing of the material resulted in an increase in electrical conductivity of ~ 20% for Palysium C+ (33 % IACS) while maintaining a high hardness of 400 HV. Consequently, the corresponding Current Carrying Capability of Palysium C+ which is an effective performance indicator of a probe material / needle (influenced by the material properties as well as probe needle design) was measured to be 700 mA, also reflecting an increase of around 20% in comparison to Palysium.

- ***CCC-Test performed under following conditions**
  - **8 mm needle length, 41 µm diameter, flat tip**
  - **75 µm overdrive, 250 µm offset**
  - **120 s cycle time, 10 s between cycles**
  - **Test performed @ room temperature**

Contacts

Would you like to know more?

GET IN TOUCH WITH OUR EXPERTS

- **DR. MATTHIAS WEGNER (MATTHIAS.WEGNER@HERAEUS.COM)**
- **NAIL AKROUTI (NAIL.AKROUTI@HERAEUS.COM)**
- **LOUIS FAY (LOUIS.FAY@HERAEUS.COM)**
- **MARTIN SENZEL (MARTIN.SENZEL@HERAEUS.COM)**

WWW.HERAEUS.PM/PROBING