

# P14.1 Summary Talk – Sessions A

R. Krause-Rehberg

- Sessions Statistics
- Details

# Sessions Statistics – Sessions A

- Methodical improvements/New Installations 12
- Defects in Semiconductors/Isolators 11
- Defects in Metals/Alloys 9
- Theory 4
- PAES 3
- 2D-ACAR 3

(only for session A)

⇒ Session of New Equipment & Defects

# Methodical Improvements / New Installations

## New Installations

- Doyama: transmission positron microscopes (pictures of different objects shown on image plates)
- KEK: microprobe using LINAC  $\rightarrow 10^6$  e<sup>+</sup>/s and 0.1 mm are expected; transmission moderators
- AIST: 2-generation pulsed beam with own LINAC (>5kW); 50kHz pulse repetition; after first Buncher  $10^8$  /s; after focusing  $10^6$ /s @ 1 $\mu$ m
- EPOS: starts with 5 ps e<sup>+</sup> bunches; remote controlled; Multi-detector system; fully digital
- WSU: Deuteron accelerator converts C to <sup>13</sup>N (10 min halflife)
- APosS: Argonne Positron source; uses LLNL equipment; 15 MeV @ 0.2 mA; also experiments from LLNL: holography + microprobe

- NEPOMUC: at FRM-II in Munich most universal and strongest source so far available; 2 PAES spectrometers; CDBS; Ps<sup>-</sup> experiment; SPM; PLEPS; about 10<sup>8</sup> e<sup>+</sup>/s after first re-moderation
- PULSTAR reactor: University reactor centre; 1MW power; positron source by North Carolina State Univ, Univ. of Michigan, ORNL; 6x10<sup>8</sup> e<sup>+</sup>/s expected; e<sup>+</sup> and Ps spectrometer; Cd converter & W moderator

# Methodical Improvements / New Installations

## Methodical improvements

- Gaussian analysis of DB-curves shows depth distribution of different annihilation sites
- Enhanced-depth resolution profiling
- S-W-plot used in quantitative manner for defect profiling (only one defect type)

# Defects in Semiconductors / Isolators

- Decorated vacancy clusters in **Si** after He-implantation; decoration found by CDBS and lifetime ( 2 talks)
- Monovacancies in ion-implanted **Si**
- thermally generated vacancy-donor complexes in **highly-doped Si**
- defects already before in virgin **ZnO** and after N-implantation (built-in H); implanted impurities (B, Al) trap  $O_i$  and stabilize  $V_o$
- proton bombarded **6H-SiC**: annealing stages of vacancies discussed
- **UO<sub>2</sub>**: long-term fuel; electron and He irradiation study
- defects in **diamond**
- **CdTe** films on different substrates
- 2D-ACAR study of **porous Si**
- nano-pore formation in **silica PECVD** films

# Defects in metals and alloys

## Al alloys

- two talks: role of vacancies during precipitation (formation of GPZ)
- CDBS + PALS study of Aluminum 2037 cast alloy (AlCuMgMn)

## Others

- n-irradiated **Fe** and **Fe-Cu** (in coincidence setup); clustering of Cu and vacancies observed
- alloys for RPV **steel** and fission/fusion technology (PLEPS)
- **H-loaded Nb** (bulk and film: H-induced vacancies; comparison with theory: 4 vacancies at a vacancy; loading/unloading experiments)
- **Cu-Zr** amorphisation by repeated folding & rolling
- **Fe-Al** order-disorder transition; structural vacancies observed
- phase-transition induced vacancies in metals and alloys

# Nano-Materials

- 2D-ACAR study of surfaces of nano-crystals
- ZnS - MnS nano-particles
- GPZ in Al and Fe alloys are nano-particles
- nanoporous material (low-K ...)



# Theory

- First-principle calculations of PA characteristics in solids
- calculation of momentum distribution (PAW method: accurate and reliable)
- many-body effects seen in PA
- SIESTA code

# Positron-induced Auger effect

- progress was made in PAES (Se layers on Si; TOF spectrum of  $\text{Cu}_2\text{O}$ )
- new setup at FRM-II Munich starts operation: Auger yield orders of magnitude higher compared to AES
- second spectrometer at FRM-II: TOF setup ready for use

# Conclusion

- defects in metals / Semiconductors still important
- nano-materials are important issue
- new experimental installations and theoretical improvements will give new possibilities
- network with other positron methods and corresponding methods needed

Photos of social events available:

**[http://www.krauserehberg.de/ICPA-14\\_Photos/](http://www.krauserehberg.de/ICPA-14_Photos/)**

please send me your photos to be included in this website