Contribution ID: **70** Type: **Oral Presentation**

Intermediate Valence behavior in the new ternary compound Yb₁₃Pd₄₀Sn₃₁

Tuesday, 4 July 2017 10:00 (20 minutes)

The new ternary intermetallic compound Yb₁₃Pd₄₀Sn₃₁ was obtained as part of the investigation of the isothermal section of the Yb-Pd-Sn system at 600℃ [1]. The polycrystalline sample was prepared by induction melting method in sealed tantalum crucible under a stream of pure argon gas. The powder x-ray pattern indicated that the sample crystallizes in a hexagonal structure, similar to hP168-Yb₁₃Pd₄₀Sn₃₁ [1]. Magnetic susceptibility measurement depicted a strange and non-regular temperature dependence in applied magnetic field of 0.01 T. The inverse magnetic susceptibility does not obey Curie-Weiss law throughout the measured temperature range (400 K – 2 K).This behavior is unexpected for Yb in its magnetic Yb³⁺ state and suggests that the system is well described by the interconfiguration fluctuation (ICF) model, having an unstable valence for Yb ion. The temperature dependent electrical resistivity shows that the compound becomes superconducting below 2.3 K, however, there are some speculations about the bulk character of this superconductivity ground state. Specific heat analysis shows that the anomaly at 2.3 K survives even in 1 T but is completely suppressed in B = 4 T. As a most important discovery, we observe that, aside from the peak at T_{sc}, there is an enormous upturn in the Cp(T)/T vs T graph towards lowest temperature than can be assigned as a first thought to a form of nuclear entropy.

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MSc

Main supervisor (name and email)
and his / her institution

Prof. Andre M. Strydom

University of Johannesburg

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Session Classification: Physics of Condensed Matter and Materials 1

Track Classification: Track A - Division for Physics of Condensed Matter and Materials