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## Hidden Amorphous Phase and Reentrant Supercooled Liquid in Pd-Ni-P Metallic Glasses

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*An anomaly in differential scanning calorimetry has been reported in a number of metallic glass materials in which a broad exothermal peak was observed between the glass and crystallization temperatures. The mystery surrounding this calorimetric anomaly is epitomized by half century long studies of Pd-Ni-P metallic glasses, arguably the best glass-forming alloys [1]. Here we show, using a suite of in-situ experimental techniques, including simultaneous small-angle neutron scattering-calorimetry, high-energy X-ray diffraction, and electron microscopy, that Pd-Ni-P alloys have a hidden amorphous phase in the supercooled liquid region. The anomalous exothermal peak is the consequence of a polyamorphous phase transition between two supercooled liquids, involving a change in the packing of atomic clusters over medium-range length scales as large as 18Å. With further temperature increase, the alloy reenters the supercooled liquid phase which forms the room-temperature glass phase upon quenching. The outcome of this study raises a possibility to manipulate the structure and hence the stability of metallic glasses through heat-treatment.*

[1] Lan, S. et al.. Hidden amorphous phase and reentrant supercooled liquid in Pd-Ni-P metallic glasses. *Nature Communications*, 8, 14679, 2017. Doi:10.1038/ncomms14679