# Physical properties of the $Ti_{45}Zr_{38}Co_{17}$ nano-alloy and their amorphous hydrides.

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The amorphous and quasicrystalline Ti-Zr-Ni alloys have raised an interest due to the wide range of their potential applications. The large hydrogen uptake capacity makes the TiZrNi compositions promising candidates for hydrogen storage and battery applications. The $Ti_{45}Zr_{38}Ni_{17}$ compositions can be modified by substituting the other 3d transition metals for Ni, replacing Ni with Fe and Co. However, the basic properties of the Ti-Zr-Co alloys, including the magnetic properties, have not been extensively researched yet. The most interesting questions regarding magnetism at TiZrCo system are: a) why amorphous phase shows ferromagnetism? b) why quasicrystals phase can exhibit long-range magnetic ordering? The present work aimed to track the $Ti_{45}Zr_{38}Co_{17}$ phase transformation from the amorphous to the quasicrystalline/crystalline capturing change of magnetic properties. We succeeded in obtaining the amorphous $Ti_{45}Zr_{38}Co_{17}$ alloys with the full capacity of hydrogen. The amorphous phase is stable up to the temperature of $300^oC$. During further heating, a quasi-continuous transformation to the i-phase occurs. Close to $500^oC$, the reflections of the i-phase were well developed. Hence, the quasi-continuous character of the transition from the amorphous into quasicrystalline phase was evidenced. Structure of $Ti_{45}Zr_{38}Co_{17}$ started to evaluate from the i-phase into the w-phase above $500^oC$, an additional transition close to $700^oC$ from the w-phase into the new cubic phase was noticed. The possibility of obtaining the amorphous but hydrided alloys with the hydrogen capacity exceeding 2.39 wt.% is extremely interesting in the context of hydrogen storage. The mechanically-alloyed, initially amorphous, $Ti_{45}Zr_{38}Co_{17}$ material undergoes the structural transformation into the quasicrystalline state, the i-phase is changed to the approximant w-phase, which is transformed into a cubic phase. The amorphous phase with its hydrides shows a ferromagnetic behavior. The quasi-phase is not magnetic at all structure, with a small addition of ferromagnetic phase.