Unusual devitrification behaviour in rapidly solidified $Ti_{45}Zr_{38}Ni_{17}$ alloy

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In this study, $Ti_{45}Zr_{38}Ni_{17}$ ribbons have been elaborated using planar flow casting method ($v_{quenching}$ = 10^6 K s^{-1}). The rapidly quenched samples, displaying a dispersion of nanoscaled β phase particles in an amorphous matrix, have been extensively characterised using transmission electron microscopy (TEM) and X-ray diffraction (XRD). Devitrification behaviour, investigated by four-probe resistivity measurements and differential scanning calorimetry as well as high resolution TEM analysis, revealed the formation of nanometric quasicrystals (QC) during the first exothermic phase transformation as well as the precipitation of omega domains inside β particles. On the basis of these data, it has been noticed that nanoscaled β metastable particles had adopted the same temperature dependence as β metastable bulk. Furthermore, particular orientation relationships have been observed for QCs in the vicinity of β particles which have suggested probable influence of crystalline structure on the QCs growth, although the presence of such peculiar materials after annealing treatment could be mainly explained by an icosahedral short-range order prevailing in Ti–Zr–Ni melt and favouring their nucleation.