ESRF	**Experiment title:** **Concurrent Effect of Melt-spinning and Severe Plastic Deformation on Shape Memory Alloy Ribbons by Simultaneous XRD and Electrical Resistivity Measurements**	**Experiment number**: **MA- 1019**
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REPORT:

The experiments have been performed on the TiNiCu shape memory alloy ribbons, in the as cast (AC), severely deformed: as mild (MSPD) and very (VSPD) deformed, and VSPD and annealed (VSPDA) state. The experiments were made in the beryllium dome, with the electric resistance vs temperature (ER) measurements performed using a Keythley 2010 multimeter. The heating and cooling was performed between – 100 and + 150 ^{o}C. The shape memory alloy ribbons have been mounted on silicon wafers and insulated using kapton foil. Not all the experiments on ER were successful, but it has been proven that the equipment can be use in conjunction with the XRD to identify the onset of the phase transition and to adjust the temperature interval between two measurements according to the development of the phase transition.

EXPERIMENTAL

The results for the TiNiCu ribbon in the AC state are shown in fig.1. A single cubic (B2)→ orthorhombic (B19) reversible phase transition is detected on heating and cooling, for both the XRD and the ER spectra. The results are in the expected behavior of the TiNiCu ribbons in the high Cu compositional range.

The MSPD samples also show the B2→ orthorhombic B19 phase transition, but the ER signal is noisier (fig. 2 a-b). Based on the ER signal, there is no major difference between the as cast and MSPD state, in terms of the phase transition.

The influence of the severe plastic deformation based on RT scans is detailed in fig. 3a-c. The ER results are not reliable, in part for the fact that the samples are small (in width) ribbons and it is difficult to provide an adequate contact for the four probe measurement.

Conclusions

The use of the simultaneous XRD and ER measurements proved to be a usefull tool for the investigation of the shape memory alloy ribbons. One of the reasons for the noise that appeared amplified by the degree of inhomogenties on the surface of the investigated samples, in the transformation temperature range, can be related to the relative movement between the ribbon samples and the ER connecting pins. The deformed samples have rougher surface and relative slipping between the ER contacts and the sample can occur in a discontinuous manner.

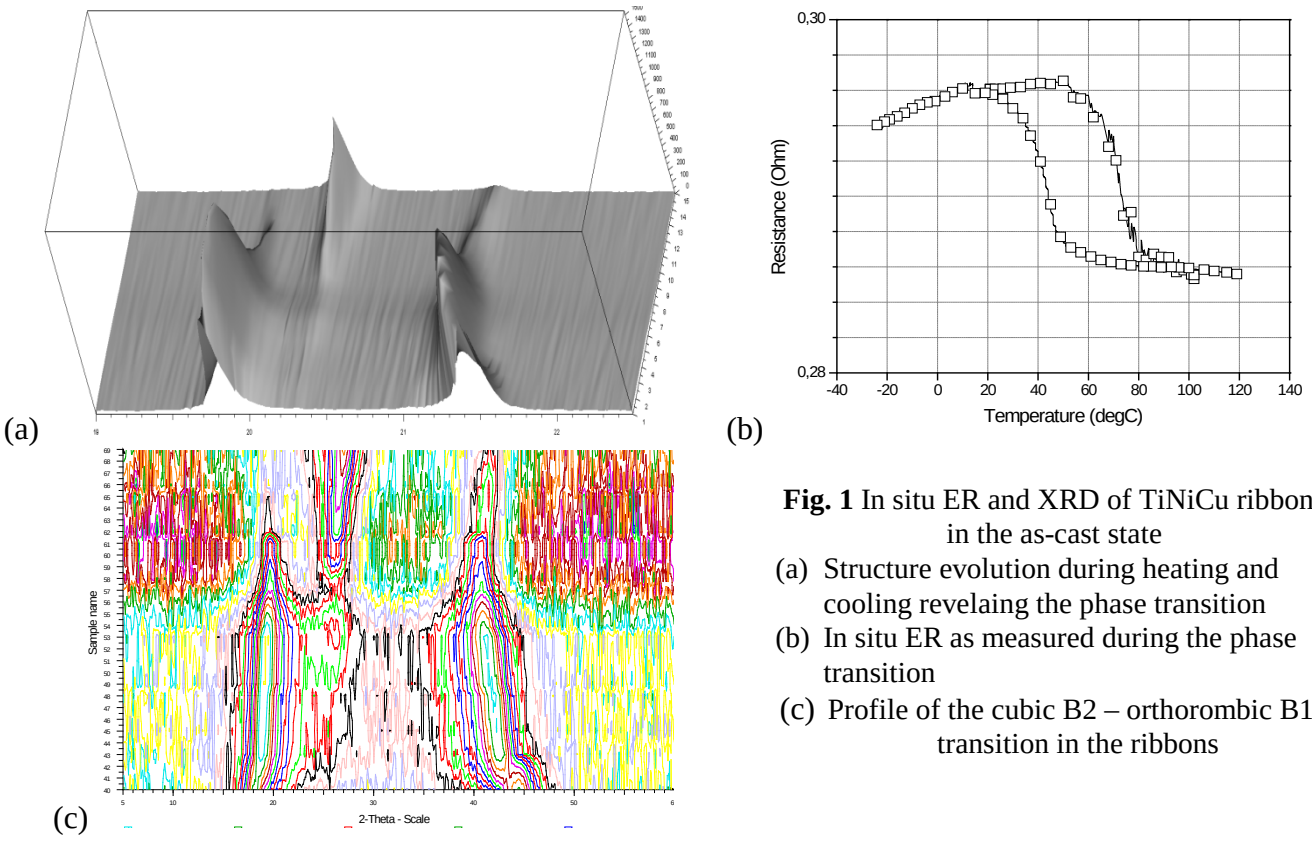


Fig. 1 In situ ER and XRD of TiNiCu ribbons in the as-cast state
(a) Structure evolution during heating and cooling revelaing the phase transition
(b) In situ ER as measured during the phase transition
(c) Profile of the cubic B2 – orthorombic B19 transition in the ribbons

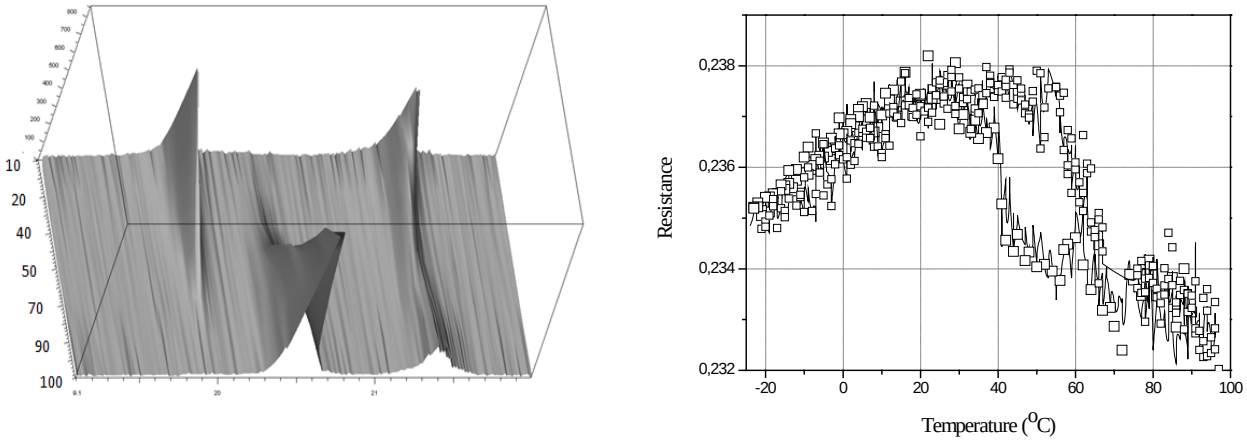
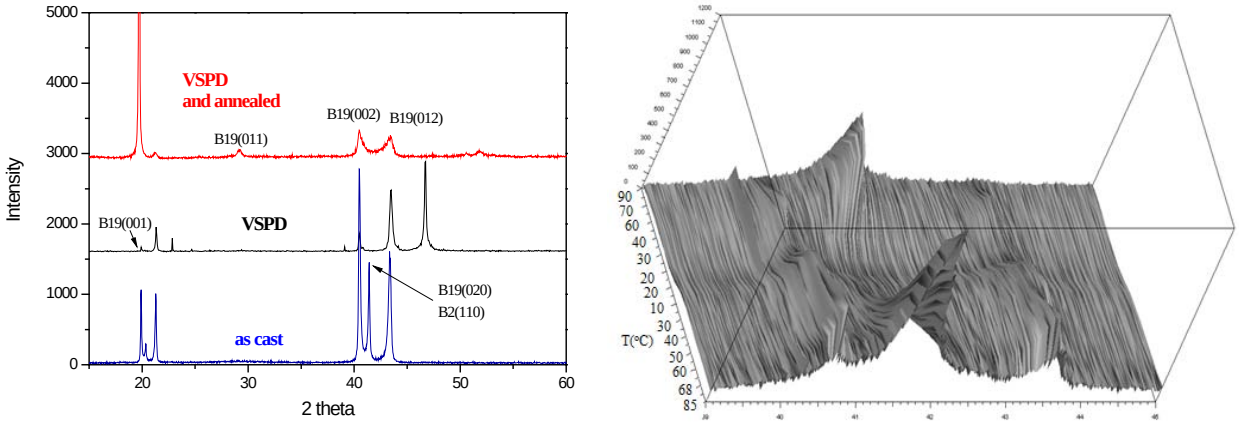


Fig. 2 In situ XRD (left) and ER(right) vs temperature scans for the as MSPD sample



(a) influence of deformation and annealing for the AC, VSPD and VSPDA samples

(b) structural evolution during heating and cooling of the VSPDA sample

Fig. 3 Structural changes as a function of the deformation state for the Ti-Ni-Cu ribbons