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Micromemory Effects in Shape Memory Alloys (*).

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Summary. — Thermoelastic martensitic transformations (TMT) have been on the stage for several years in connection with shape memory alloys. Interest has recently grown in partial cycling or involving the incomplete reverse transformation in a pre-programmable way. Attention is here focussed on the hysteresis cycle of several TMT (NiTi, NiTiFe, AgCd) related either to a complete transformation or to incomplete cycling as required to activate stimulated stepwise martensite-to-austenite reversible transformation (SMART). The modifications of the hysteresis cycles are discussed in the light both of built-in kinetics barriers and of the hierarchy of symmetries between parent and product phase.

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1. – Introduction.

Interest in shape memory alloys (SMA), grown steadily during the last twenty years, has stimulated a deep insight into thermoelastic martensitic transformations (TMT).

TMT, induced either by a modification of temperature or by an applied stress, «is a first-order diffusionless solid-state transformation, lattice-distortive with a dominant deviatoric component and associated shape change such that the strain energy dominates the kinetics and morphology of the resulting product, martensite [1]».

The interplay between features both at atomistic and mesoscopic level gives rise to a hysteresis cycle: on reverting the temperature variation, during the transformation, the sequence of thermodynamic physical states in the reverse path is different than in the forward one. The thermodynamic description of a TMT implies therefore to take into account non-chemical contributions to the free energy change, that is the elastic energy to accommodate the new phase

(*) In honour of Prof. Fausto Fumi on the occasion of his retirement from teaching.