# 3次元形状記憶素子の試作と形状回復動作の観察

純Ti線にNiメッキを施した線材をセラミックス製マンドレルに巻き付けて円筒形状を付与し，減圧雰囲気にて1173Kで種々の時間の拡散熱処理を行った．拡散熱処理後の試料にたいして行ったX線回折試験及び走査電顕観察から，TiNi形状記憶合金相が得られていることが明らかになった．示差走査熱量測定では，熱弾性型マルテンサイト変態を示す発熱ピーク及び吸熱ピークが明瞭に観察された．1173K-28.8ksの拡散熱処理した円筒状試料を室温にて形状変形し外部熱源によって加熱したところ，典型的な形状回復動作を示した．

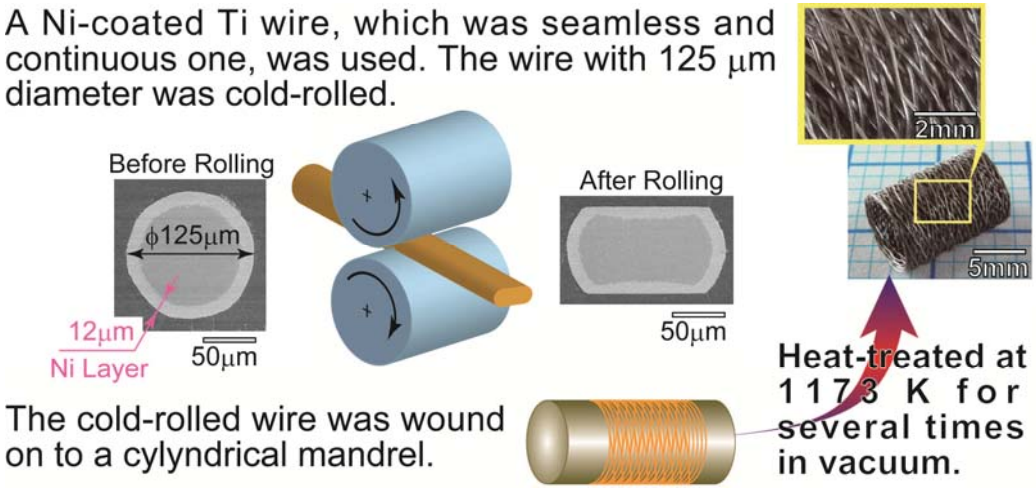


Fig.: NiメッキしたTi線を用いたTiNi形状記憶素子の製造方法

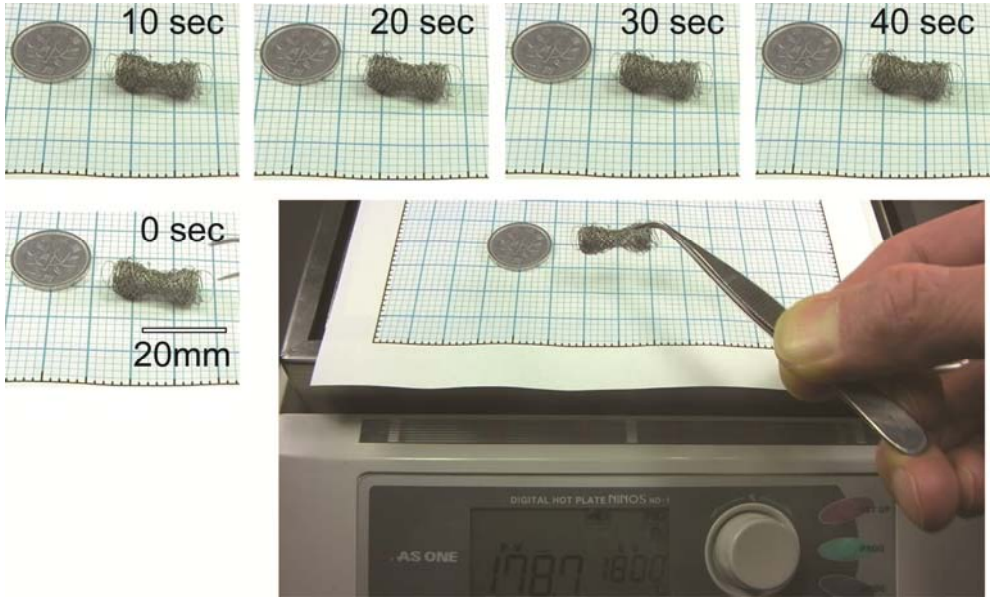


Fig.: 1173K-28.8ksの拡散熱処理で得た素子の形状回復動作．453Kに保持した加熱装置状に素子を設置して形状回復動作を観察．



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# Propose a New Fabrication Technique for a 3-Dimensional TiNi devices

A new fabrication technique for a TiNi tube-like device via a Ni-coated Ti wire was proposed. The Ni-coated Ti wire was wound on to a cylindrical mandrel. A subsequent heat-treatment, which was heated at 1173 K for various times in vacuum, was carried out. Observations of X-ray diffractometry and scanning electron microscopy show that TiNi compounds formed in the heat-treated devices. An endothermic peak and an exothermic peak in differential scanning calorimetry diagram were observed on the heating and cooling process, respectively. The device heat-treated at 1173K for 28.8ks demonstrates a good shape memory motion.

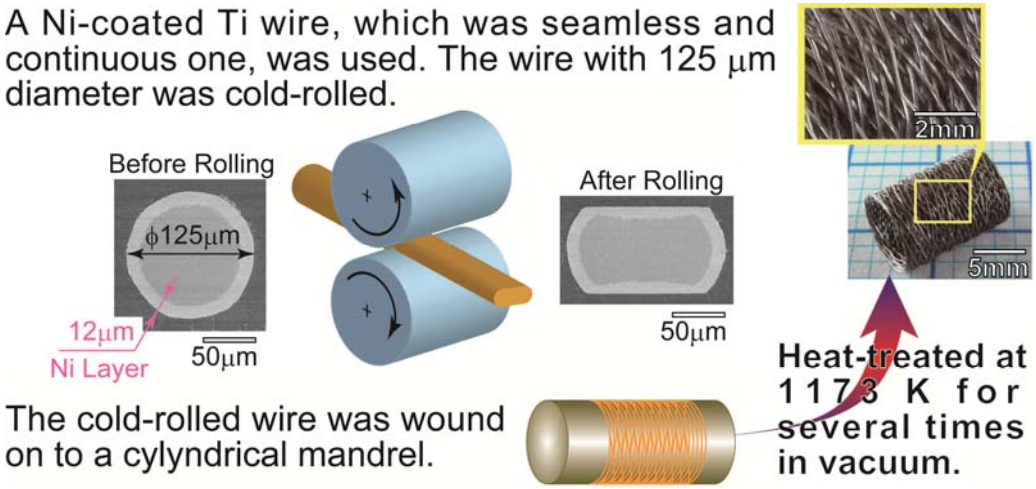


Fig.: Producing procedure for a TiNi tube-like device via a Ni-coated Ti wire.

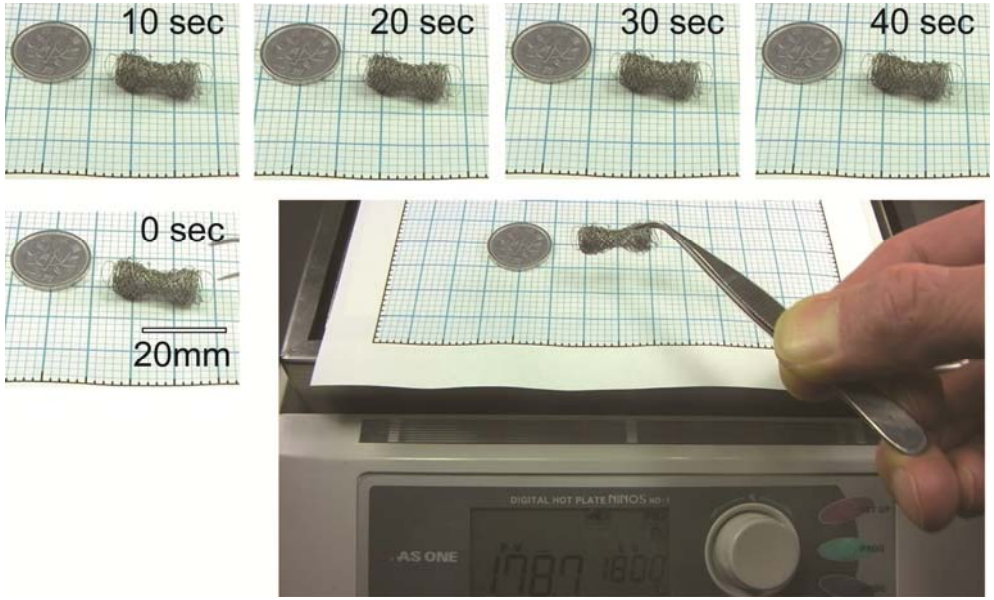


Fig.: Shape recovery motion of a tube-like device heat-treated at 1173K for 28.8ks. The device was set on an electric heating plate kept at 453K.


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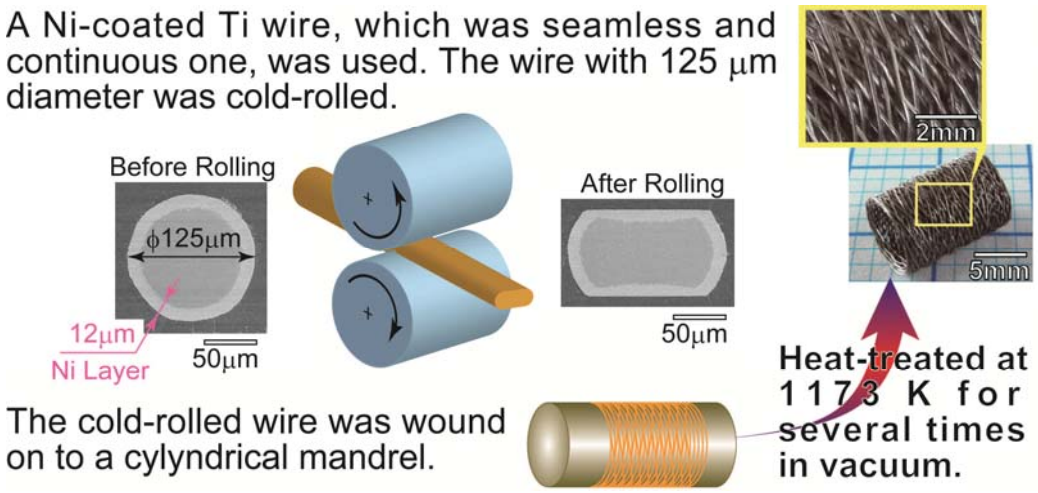


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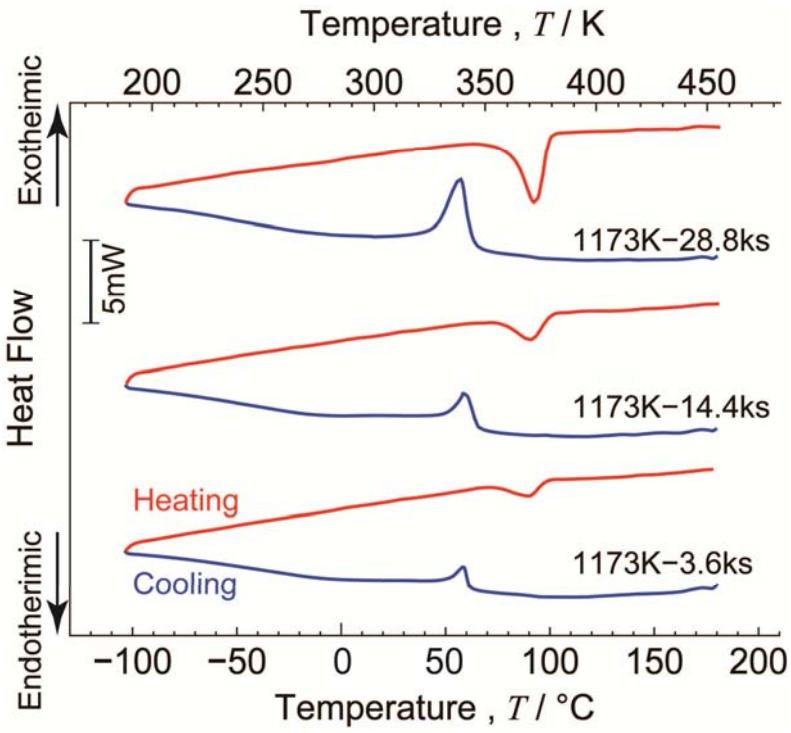


Fig.: DSC curves of Ni-coated Ti wires heat-treated at 1173K for 3.6ks, 14.4ks and 28.8ks.



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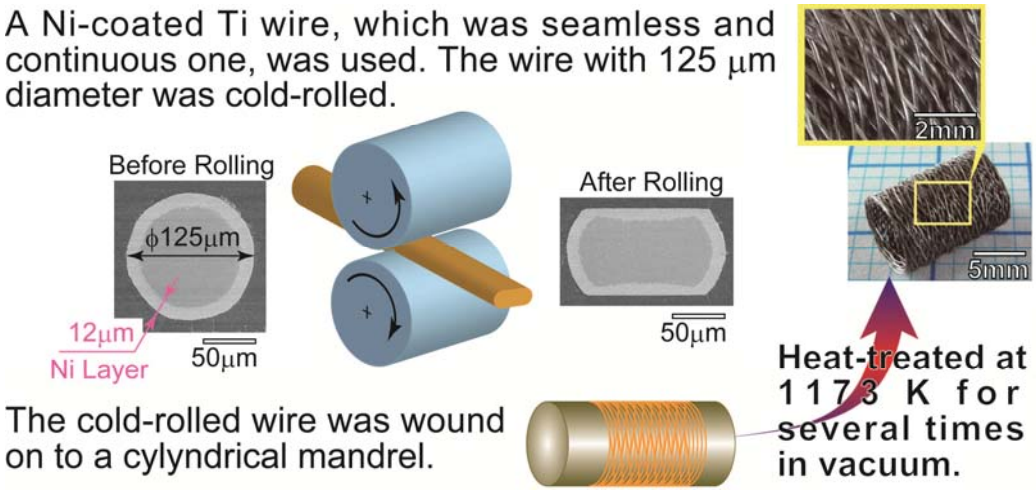
# 3次元形状記憶素子の製造法の提案

純Ti線にNiメッキを施した線材をセラミックス製マンドレルに巻き付けて円筒形状を付与した後，減圧雰囲気にて1173Kで種々の時間の拡散熱処理を行った．拡散熱処理後の試料にたいして行ったX線回折試験及び走査電顕観察から，TiNi形状記憶合金相が得られていることが明らかになった．示差走査熱量計では，熱弾性型マルテンサイト変態を示す発熱ピーク及び吸熱ピークが明瞭に観察されたので，3次元形状の形状記憶合金素子として機能することが期待できる．

（特許出願中）

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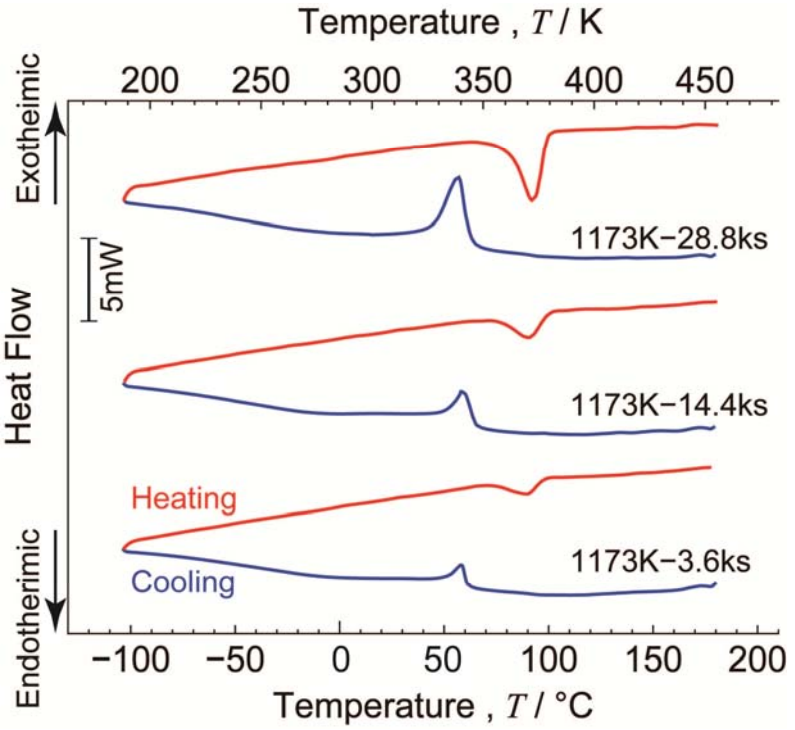


Fig.: 拡散熱処理で得た素子の変態点測定結果．典型的な発熱ピークと吸熱ピークが得られたので，形状記憶特性が付与されていることがわかる．



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