

## Electronic Supplementary Information

### Negative differential resistance based on phase transformation

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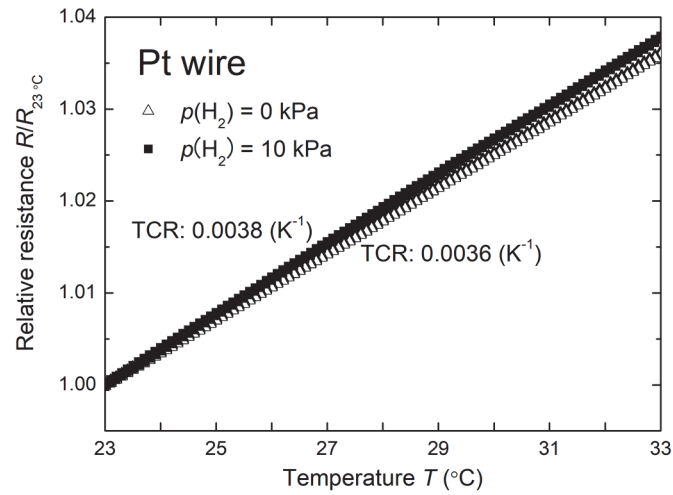
This information consists of four supplementary figures.

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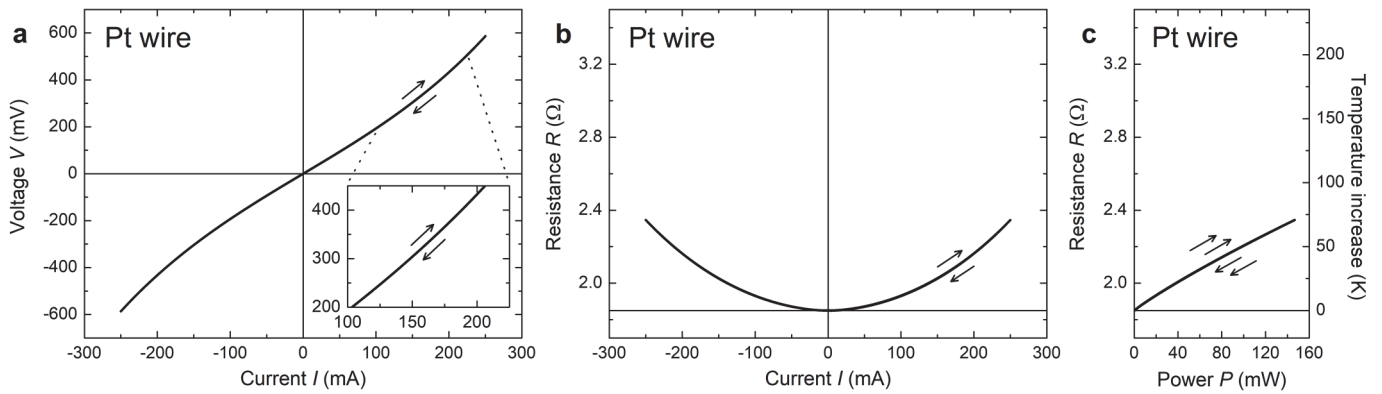
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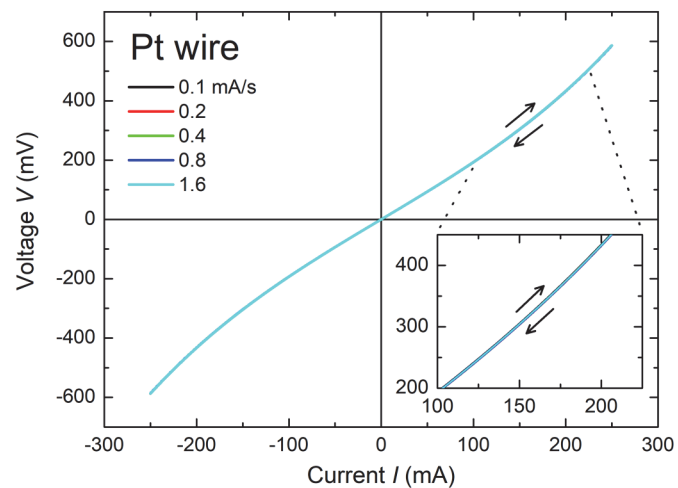
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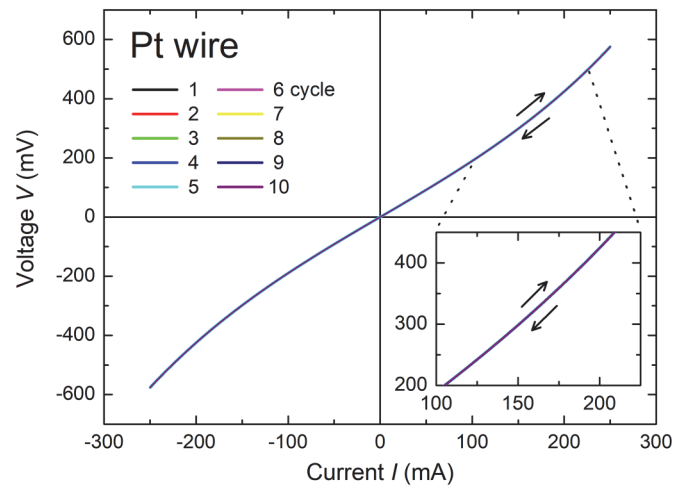
**Fig. S1** Temperature dependence of resistance ( $R$ ) of the Pt thin-wire.  $R$  is normalized using  $R$  at  $23^\circ\text{C}$  ( $R_{23^\circ\text{C}}$ ). TCR numbers shown in the figure were estimated from a slope around room temperature (range:  $23\text{--}33^\circ\text{C}$ ). TCRs at  $p(\text{H}_2) = 0$  and  $10$  kPa are almost equal to the number calculated from the Callendar-Van Dusen equation. Details are summarized in Table 1.



**Fig. S2** No NDR property on Pt thin-wire. (a) Current-voltage ( $I$ - $V$ ) curve of the Pt thin-wire measured at  $p(\text{H}_2) = 10$  kPa. Inset figure shows the close view around +150 mA where NDR was observed in the case of the Pd thin-wire. No hysteresis can be found on the Pt thin-wire. The non-linearity at large  $I$  corresponds to the self-heating. (b) Current-resistance ( $I$ - $R$ ) curve estimated from (a). The quadratic increase in  $R$  can be observed on both polarities of  $I$ . (c) Input power-resistance ( $P$ - $R$ ) curve estimated from (a). Two curves corresponding to positive and negative  $I$  are completely overlapped, indicating no dependence of current polarity. The axis on the right-hand-side shows the increase in the wire temperature, which was estimated using TCR shown in Table 1. The temperature increase is almost proportional to  $P$ .



**Fig. S3** Effect of the sweep speed on current-voltage ( $I$ - $V$ ) curves of the Pt thin-wire. All curves are overlapped and, therefore, no dependence on the sweep speed can be found on the Pt thin-wire.



**Fig. S4** Cycle characteristics of the Pt thin-wire measured at 0.4 mA/s sweep speed. All curves are overlapped, indicating no cycle dependence.