Electronic Supplementary Information (ESI) for

Ru cyclooctatetraene precursors for MOCVD

Tatsuya Ando, Naoki Nakata, Kazuharu Suzuki, Takahiro Matsumoto and Seiji Ogo*

*To whom correspondence should be addressed. E-mail: ogotcm@mail.cstm.kyushu-u.ac.jp

A Table of Contents

Table S1. A table of contents

	$[Ru^0(\eta^4\text{-COT-H})\text{-}(CO)_3]$ (**1**)	$[Ru^0(\eta^4\text{-COT-Me})\text{-}(CO)_3]$ (**2**)	$[Ru^0(\eta^4\text{-COT-Et})\text{-}(CO)_3]$ (**3**)
FTIR	previously reported	Fig. S1	Fig. S2
^1H NMR	previously reported	Fig. S3	Fig. S4
X-ray	previously reported	Fig. 4	–
TG-DTA	Fig. S5	Fig. S6	Fig. S7
melting point	Table 1	Table 1	Table 1
decomposition temperature	Table 1	Table 1	Table 1
vapour pressure	Table 1	Table 1	Table 1
SEM	Fig. S8	Fig. 6	Fig. S9
AFM	Fig. S10	Fig. 7	Fig. S11
XRD	–	Fig. S12	–
XPS	Fig. S13	Fig. 8	Fig. S14
SEM	Fig. S15	Fig. 9	Fig. S16

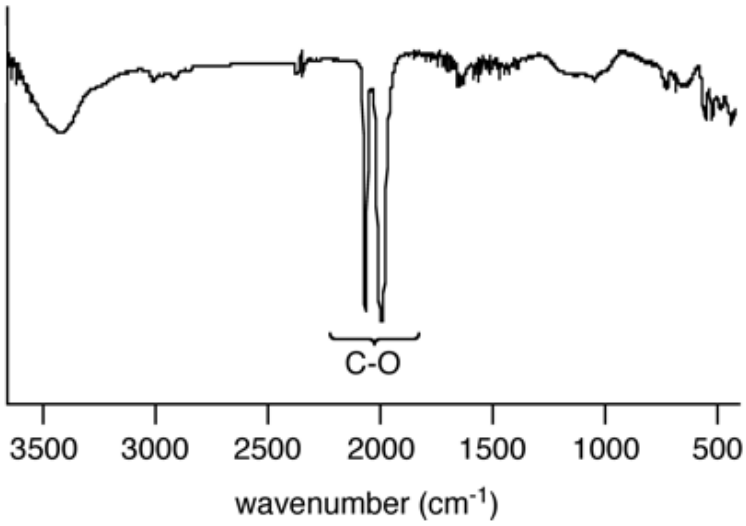


Fig. S1 IR spectrum of **2** as a KBr disk.

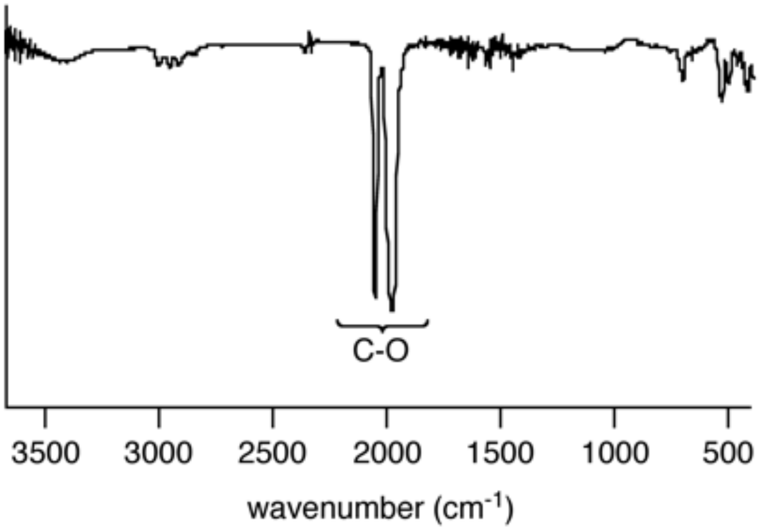
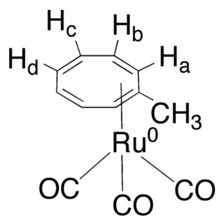


Fig. S2 IR spectrum of **3** as a KBr disk.



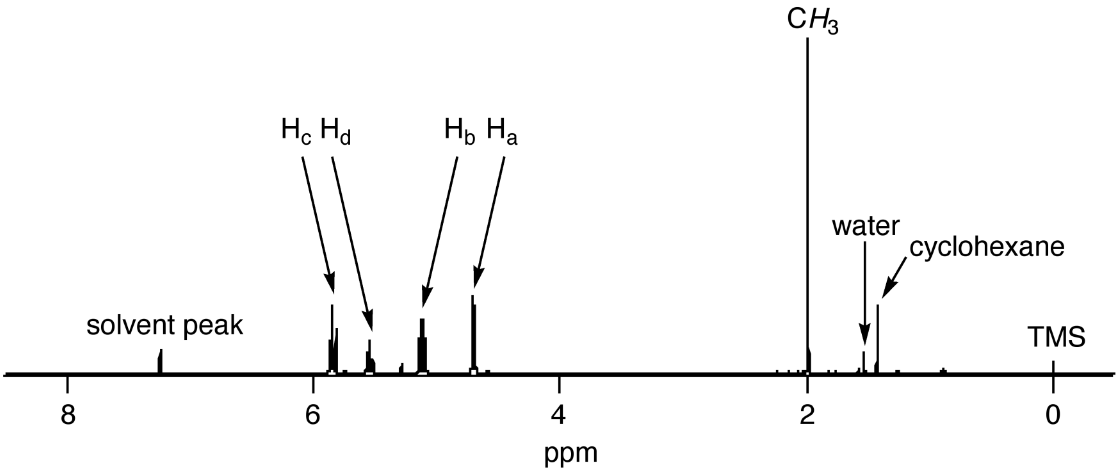


Fig. S3 ^{1}H NMR spectrum of **2** in $CDCl_3$.

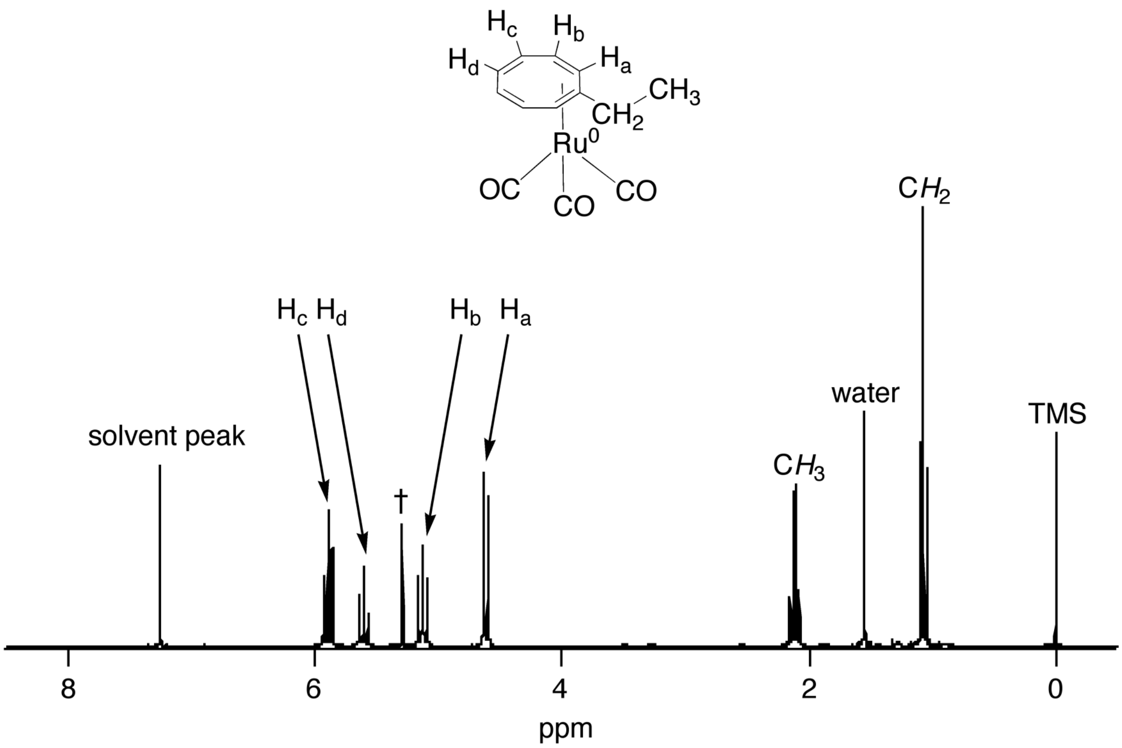


Fig. S4 [1]H NMR spectrum of **3** in $CDCl_3$. †: Impurity, **1.**

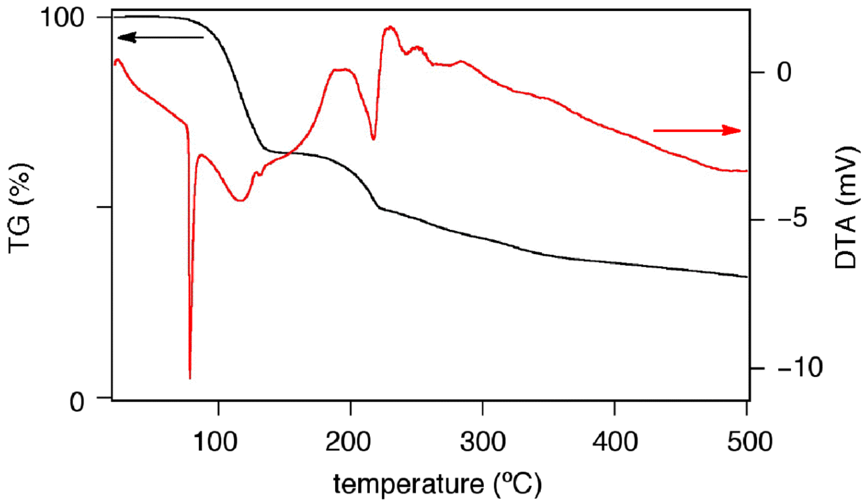


Fig. S5 TG-DTA analysis of **1** (flow gas: N_2, flow rate: 100 mL min^{-1}, heating rate: 5 °C min^{-1}).

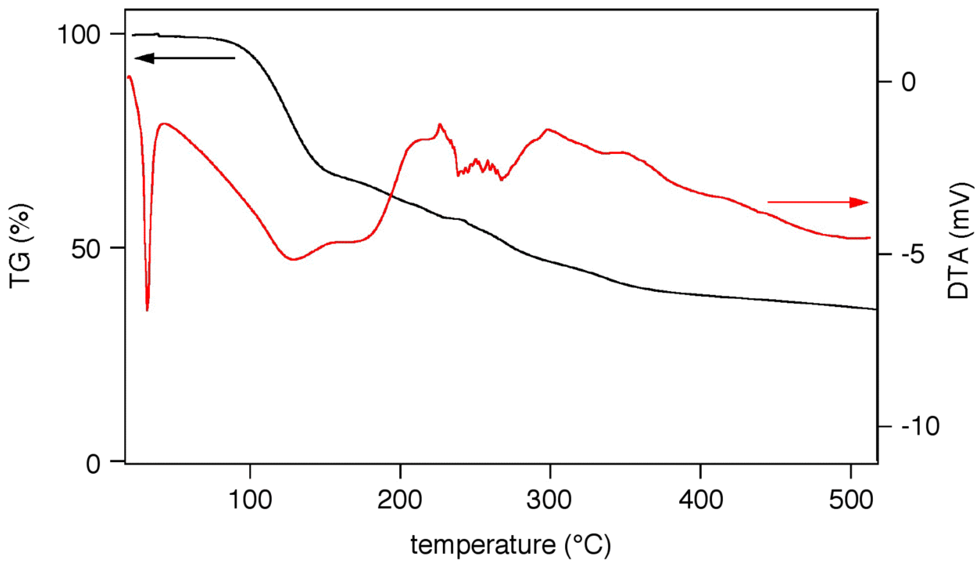


Fig. S6 TG-DTA analysis of **2** (flow gas: N_2, flow rate: 100 mL min^{-1}, heating rate: 5 °C min^{-1}).

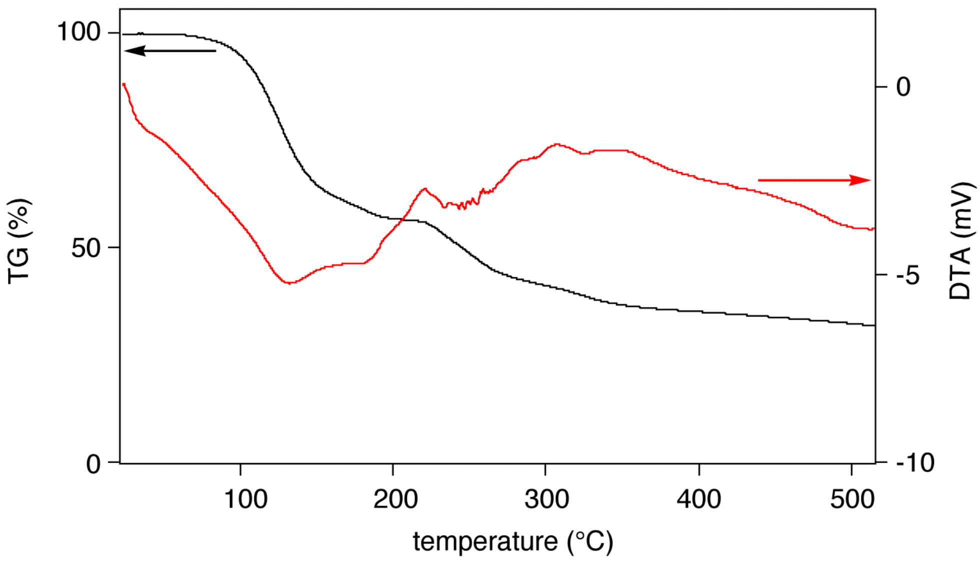


Fig. S7 TG-DTA analysis of **3** (flow gas: N_2, flow rate: 100 mL min^{-1}, heating rate: 5 °C min^{-1}).

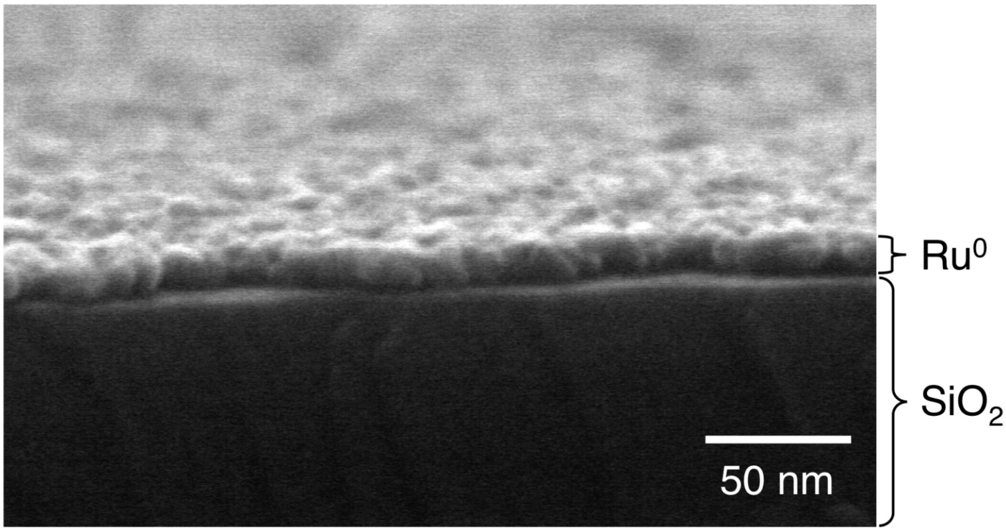


Fig. S8 A SEM image of a Ru film deposited from **1** at 165 °C under a flow of N_2 (10 sccm) and H_2 (1 sccm).

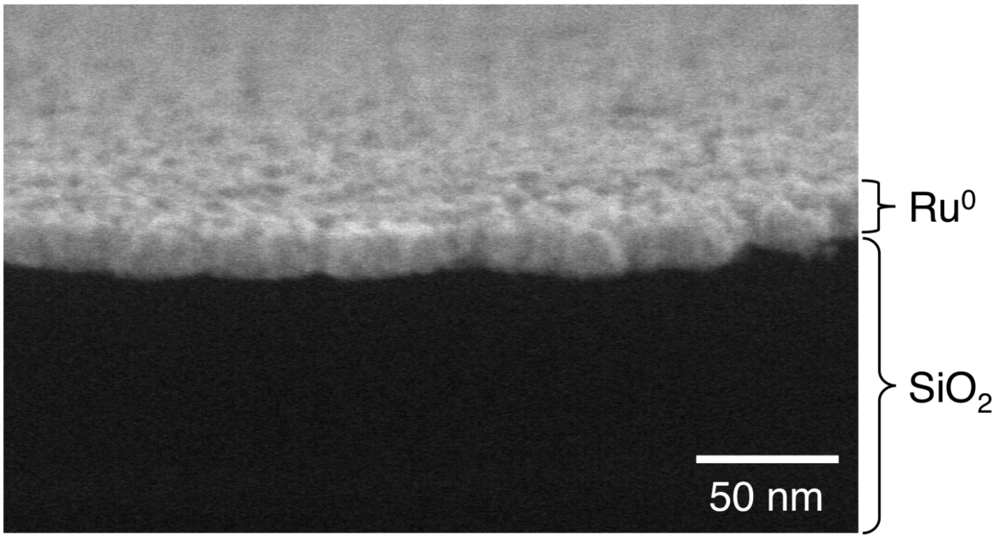


Fig. S9 A SEM image of a Ru film deposited from **3** at 165 °C under a flow of N_2 (10 sccm) and H_2 (1 sccm).

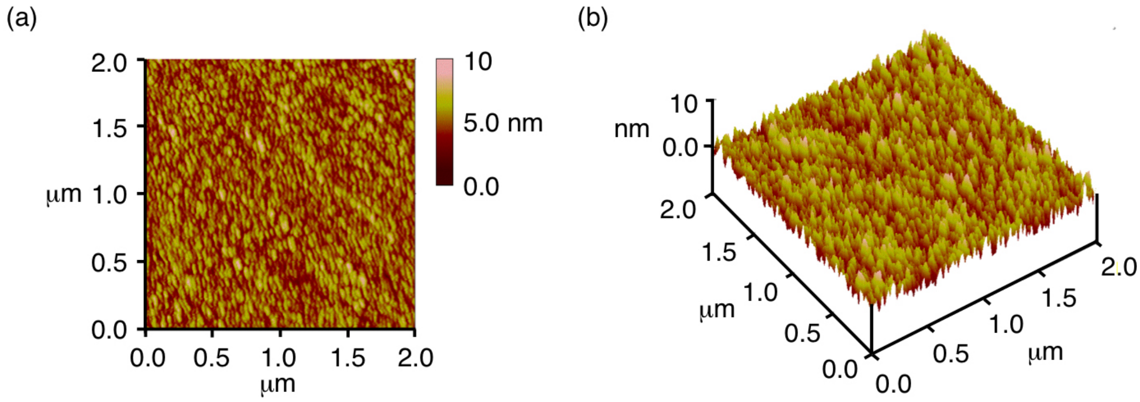


Fig. S10 An AFM image of a 17 nm thick Ru film deposited from **1** at 165 °C under a flow of N_2 (10 sccm) and H_2 (1 sccm). (a) Two- and (b) three-dimensional views.

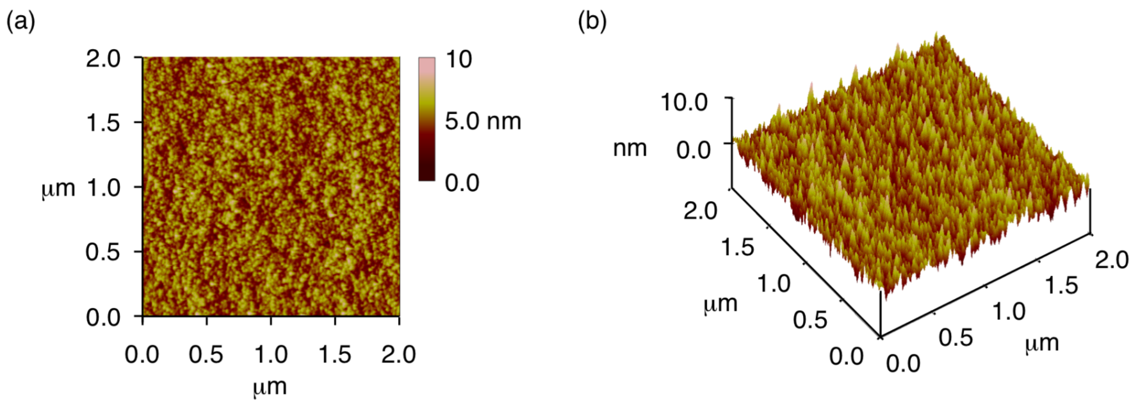


Fig. S11 An AFM image of a 49 nm thick Ru film deposited from **3** at 175 °C under a flow of N_2 (10 sccm) and H_2 (1 sccm). (a) Two- and (b) three-dimensional views.

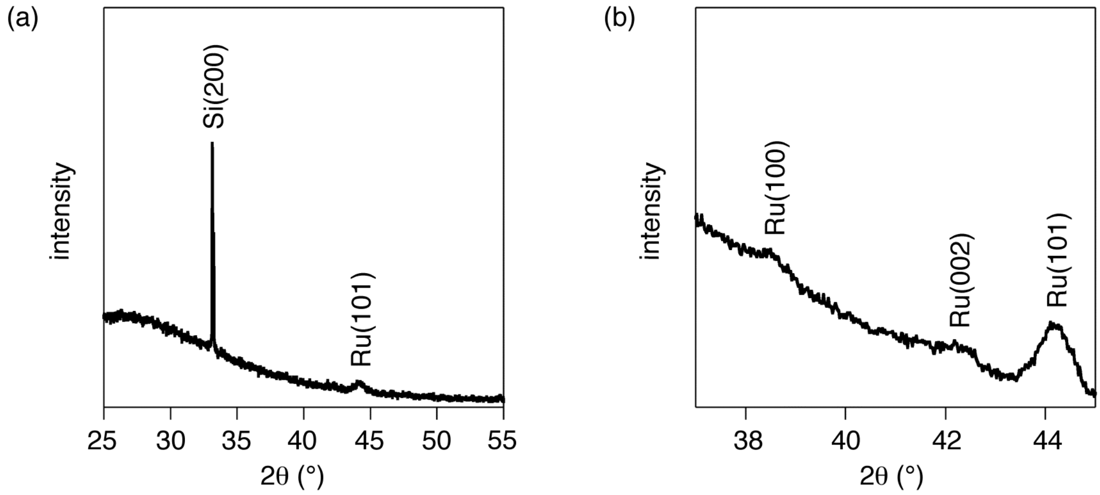


Fig. S12 (a) An XRD pattern of Ru film deposited from **2** at 165 °C on SiO_2 substrates under a flow of N_2 (10 sccm) and H_2 (1 sccm). (b) Magnification of Ru(100), Ru(002) and Ru(101) peaks in (a).

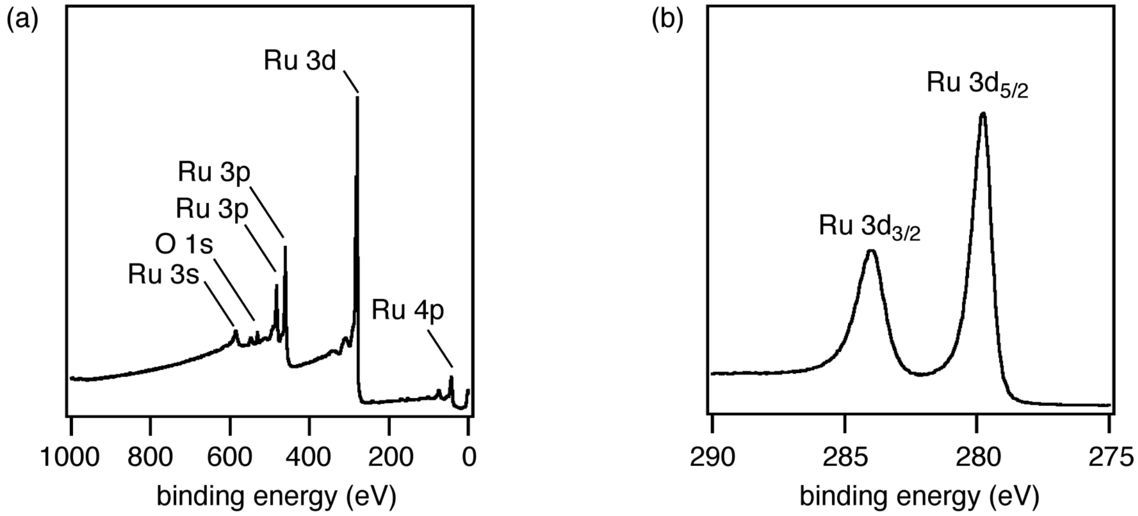


Fig. S13 (a) An XPS spectrum of a Ru film deposited from **1** at 165 °C under a flow of N_2 (10 sccm) and H_2 (1 sccm). Peaks for O 1s and Si 2p originate from a SiO_2 substrate. (b) Magnification of Ru $3d_{3/2}$ and $3d_{5/2}$ peaks in (a).

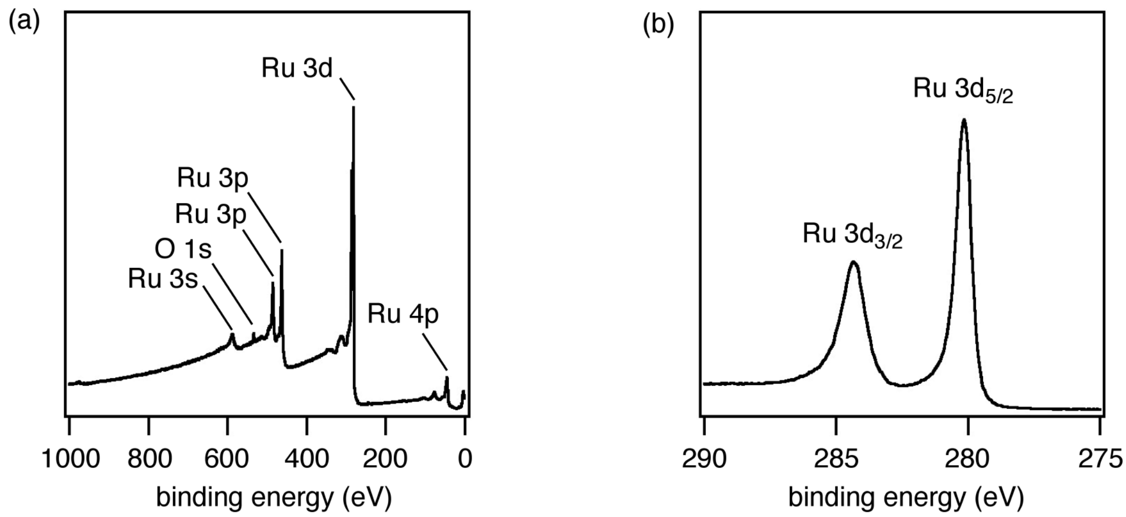


Fig. S14 (a) An XPS spectrum of a Ru film deposited from **3** at 175 °C under a flow of N_2 (10 sccm) and H_2 (1 sccm). Peaks for O 1s and Si 2p originate from a SiO_2 substrate. (b) Magnification of Ru $3d_{3/2}$ and $3d_{5/2}$ peaks in (a).

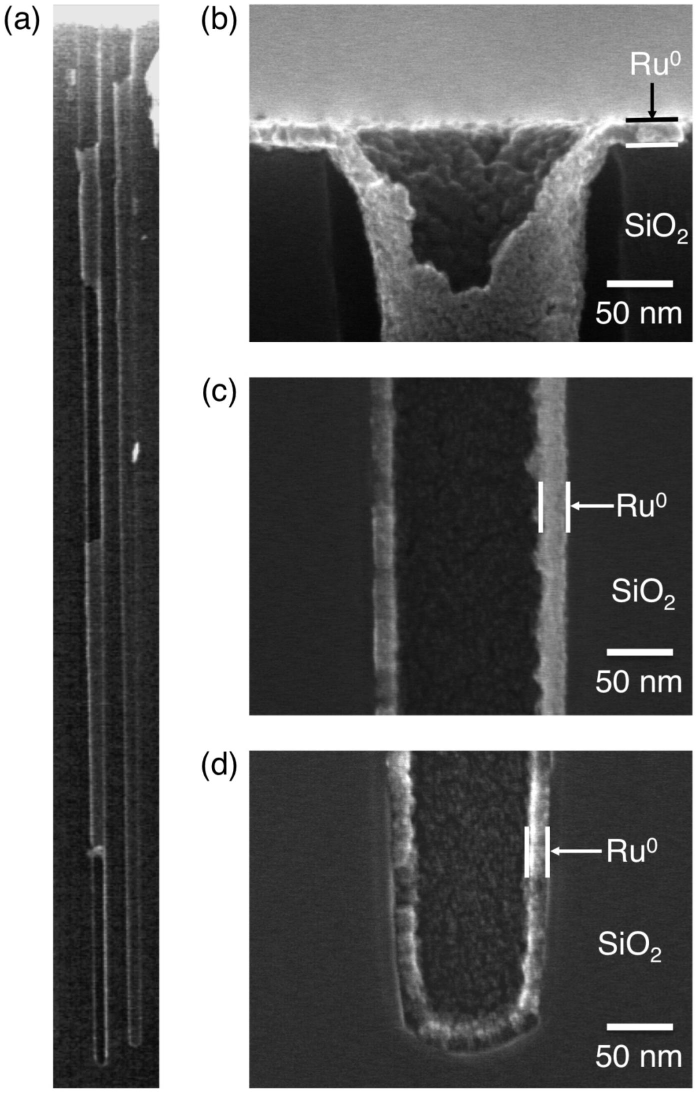


Fig. S15 (a) A SEM image of holes with aspect ratios 40:1. A Ru film was deposited at 155 °C under a flow of N_2 (10 sccm) and H_2 (1 sccm) from complex **1**. Magnified images of (b) top, (c) middle and (d) bottom of the hole.

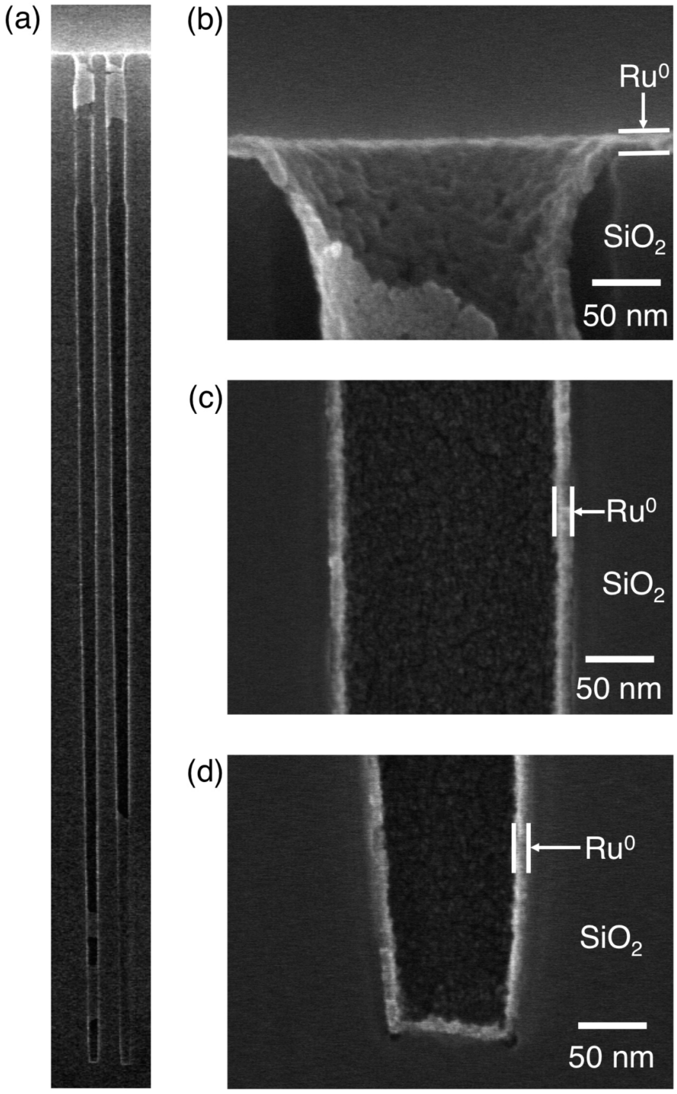


Fig. S16 (a) A SEM image of holes with aspect ratios 40:1. A Ru film was deposited at 165 °C under a flow of N_2 (10 sccm) and H_2 (1 sccm) from complex **3**. Magnified images of (b) top, (c) middle and (d) bottom of the hole.