

Supplemental Material For

Aluminum Dihydride Complexes and their Unexpected Application in Atomic Layer Deposition of Titanium Carbonitride Films

Kyle J. Blakeney, Philip D. Martin, and Charles H. Winter*

Wayne State University, Department of Chemistry, 5101 Cass Avenue, Detroit, Michigan 48202

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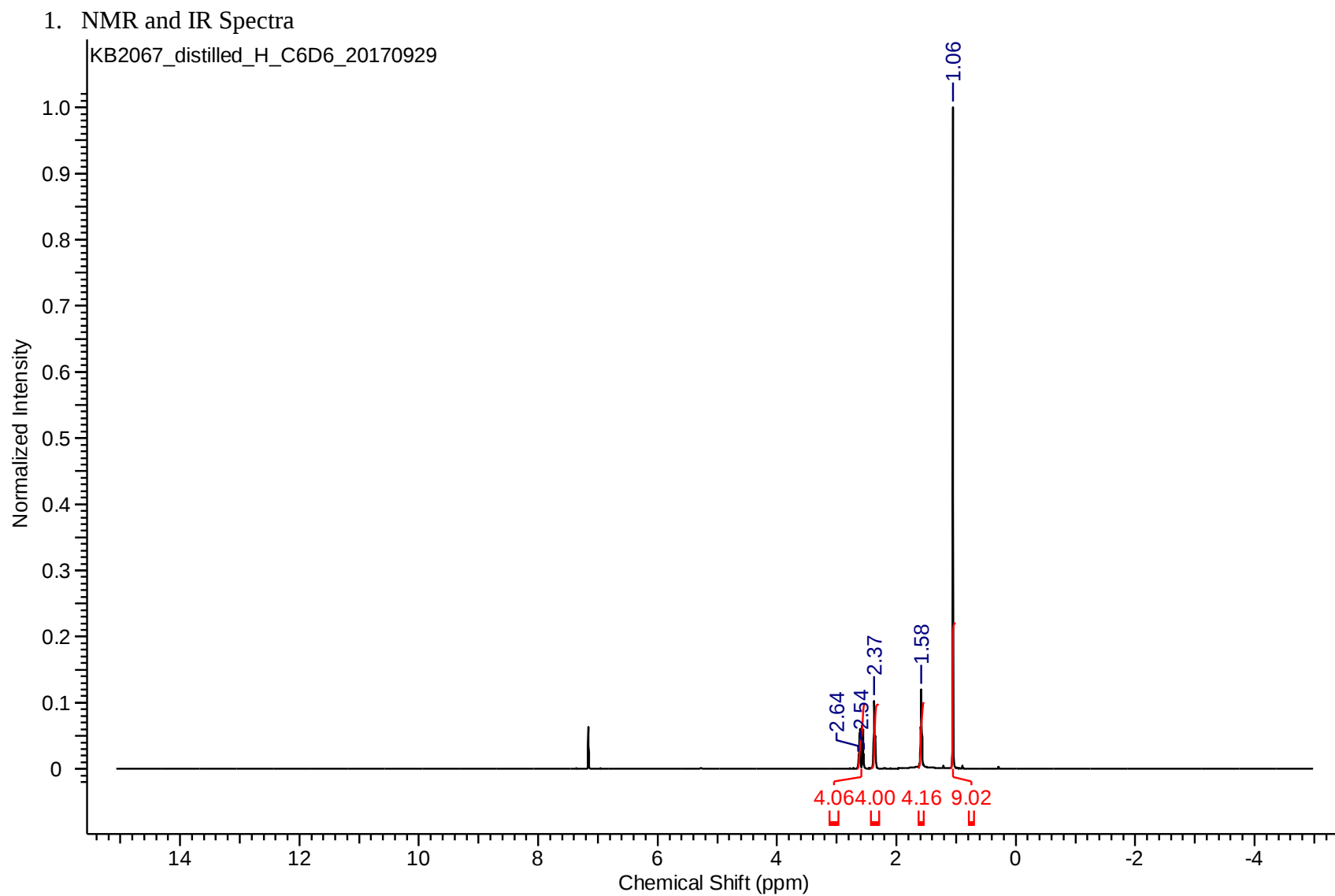


Figure S1: ^1H NMR spectrum of 1-(*tert*-butylamino)-2-pyrrolidinoethane.

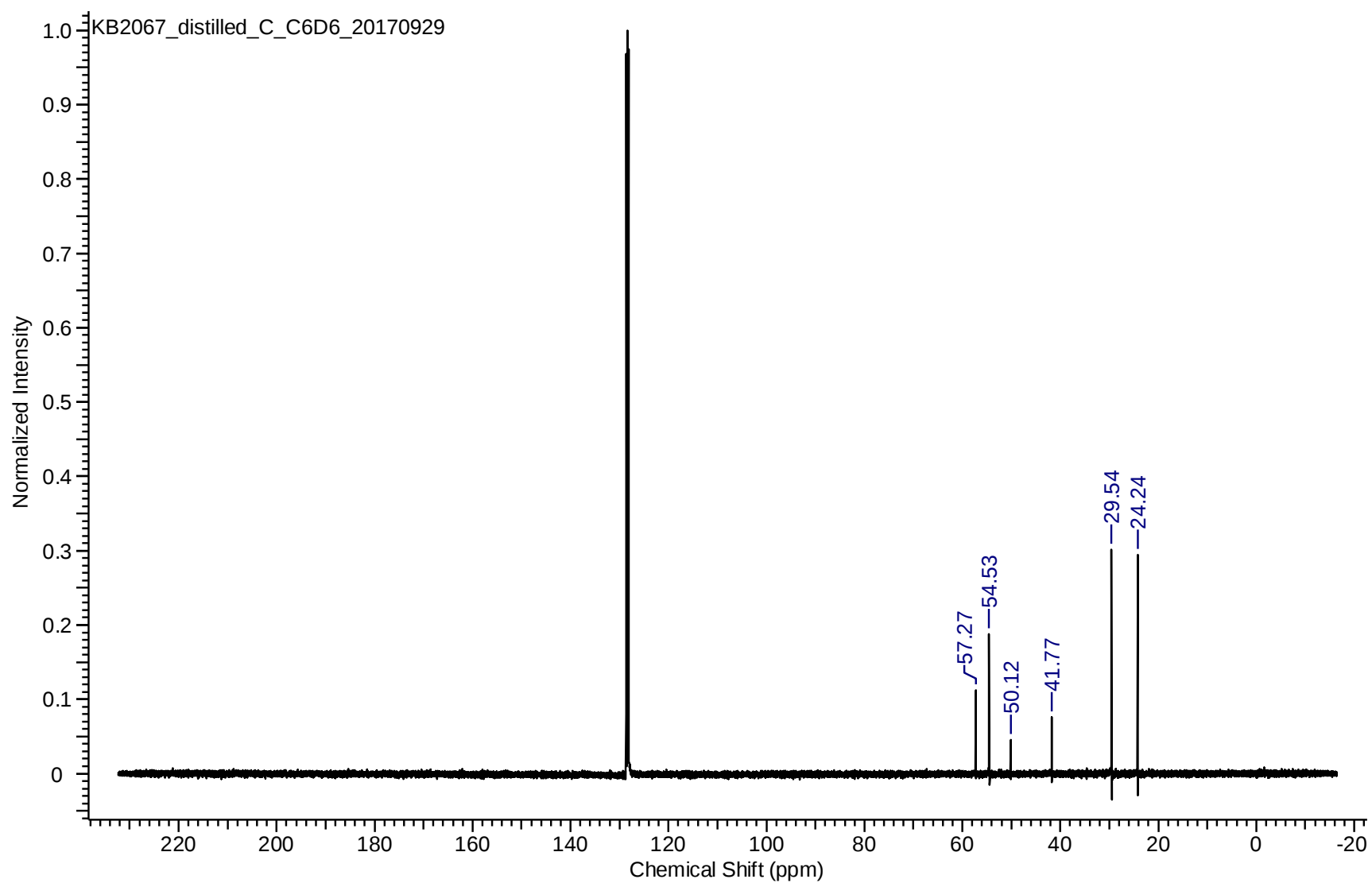


Figure S2: ^{13}C NMR spectrum of 1-(*tert*-butylamino)-2-pyrrolidinoethane.

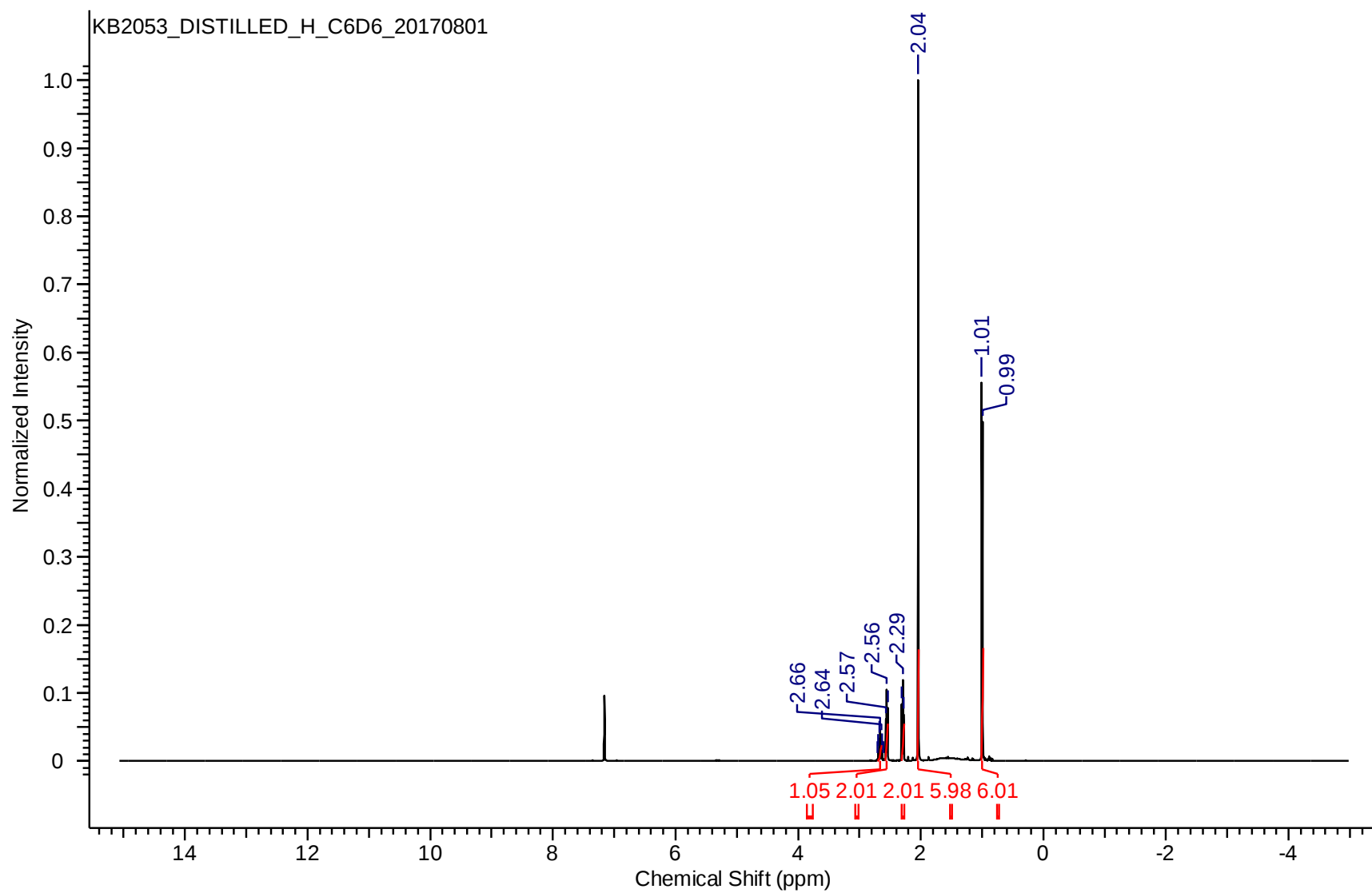


Figure S3: ^1H NMR spectrum of 1-(isopropylamino)-2-dimethylaminoethane.

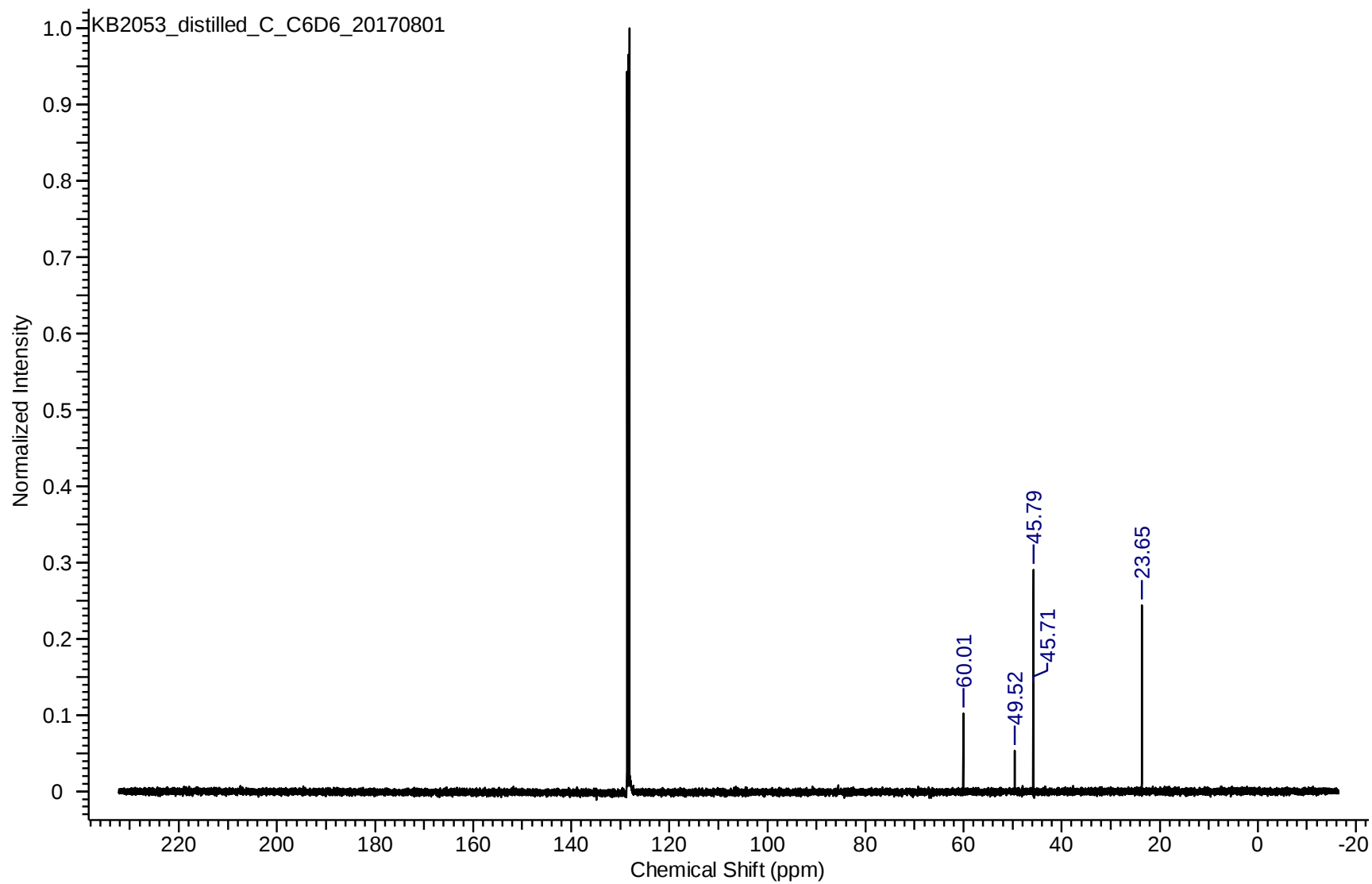


Figure S4: ^{13}C NMR spectrum of 1-(isopropylamino)-2-dimethylaminoethane.

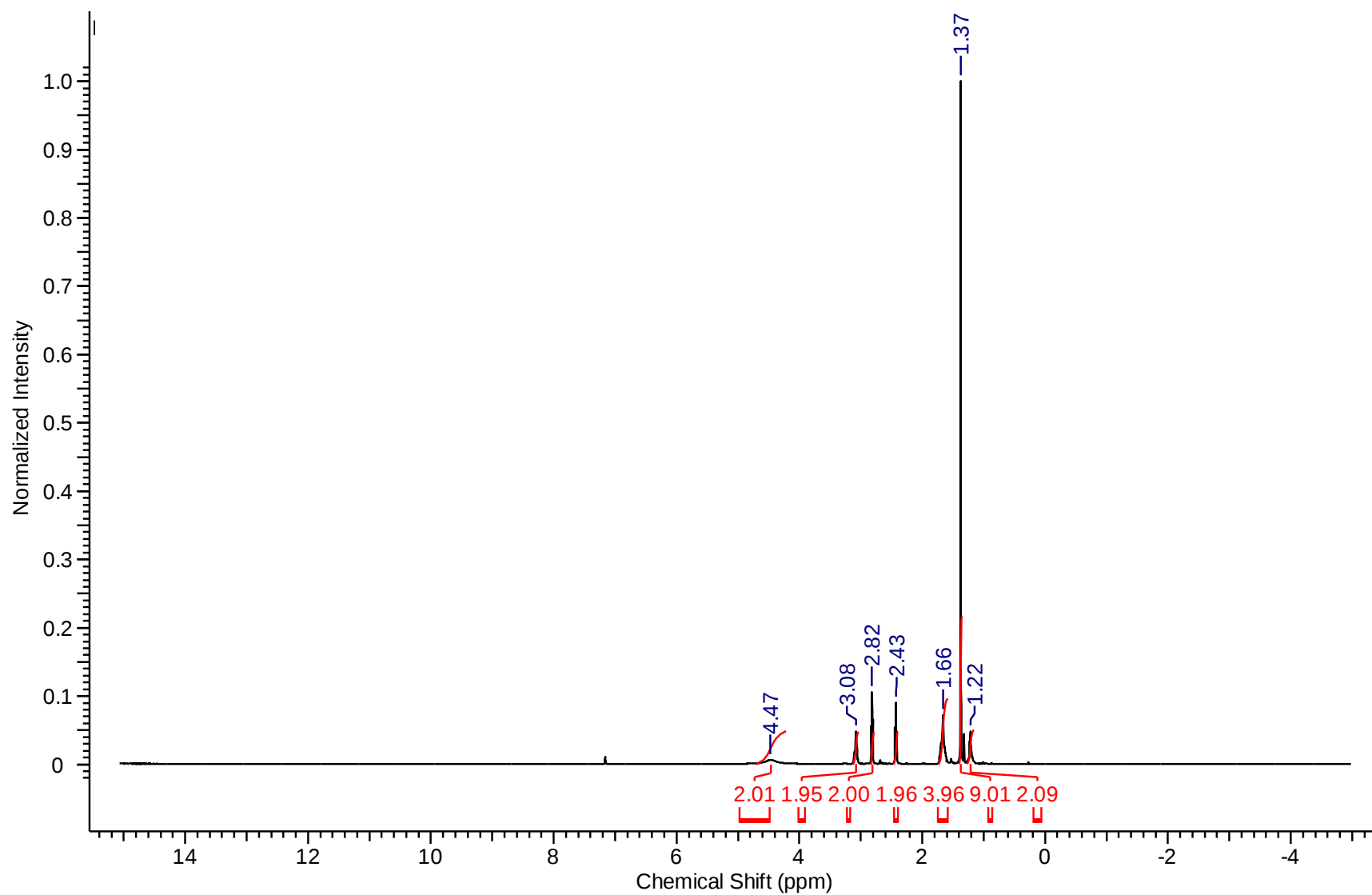


Figure S5: ^1H NMR spectrum of $\text{H}_2\text{Al}[(\text{tBuN})\text{CH}_2\text{CH}_2(\text{NC}_4\text{H}_8)]$ (2).

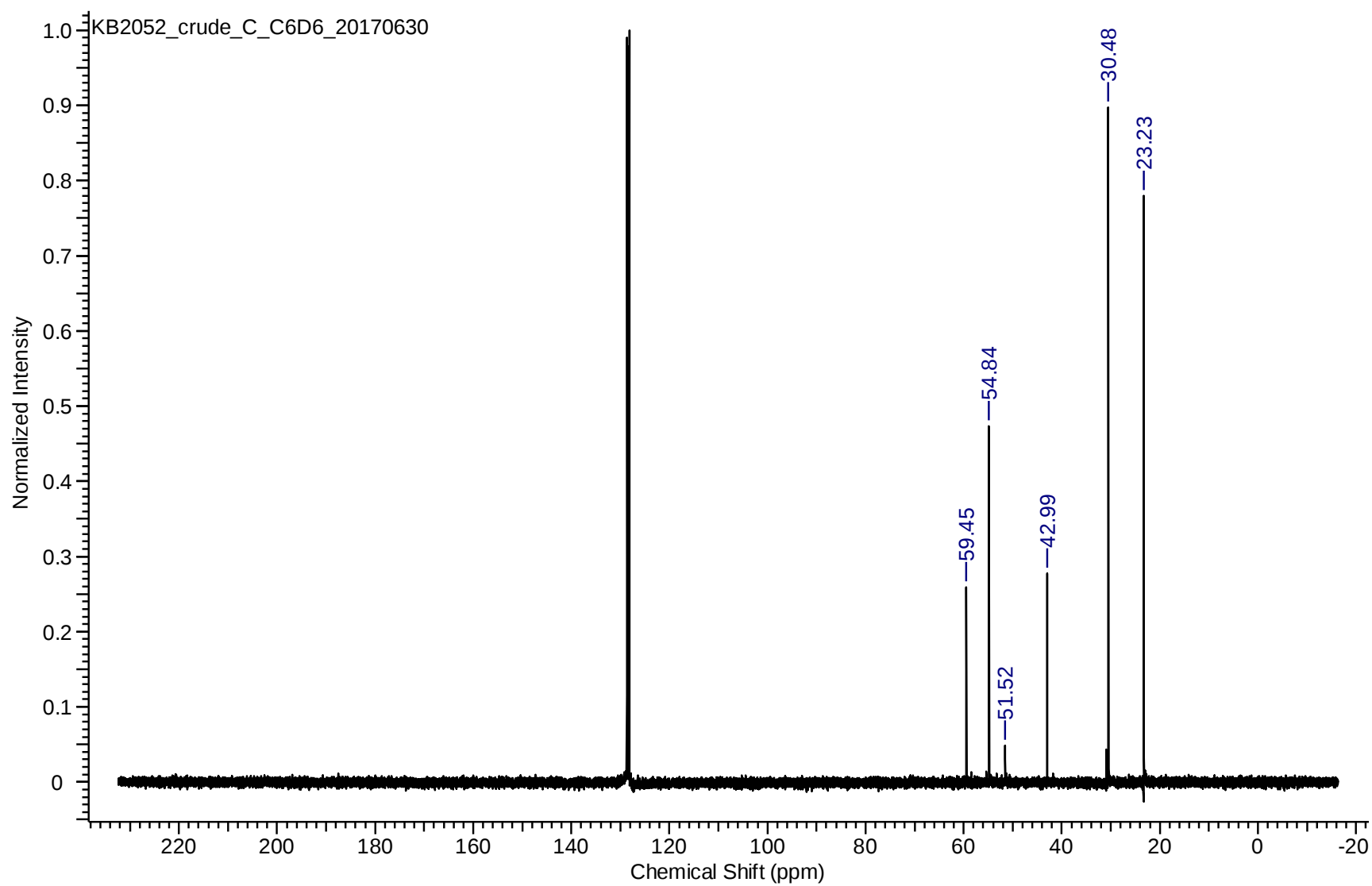


Figure S6: ^{13}C NMR spectrum of $\text{H}_2\text{Al}[(\text{tBuN})\text{CH}_2\text{CH}_2(\text{NC}_4\text{H}_8)]$ (**2**).

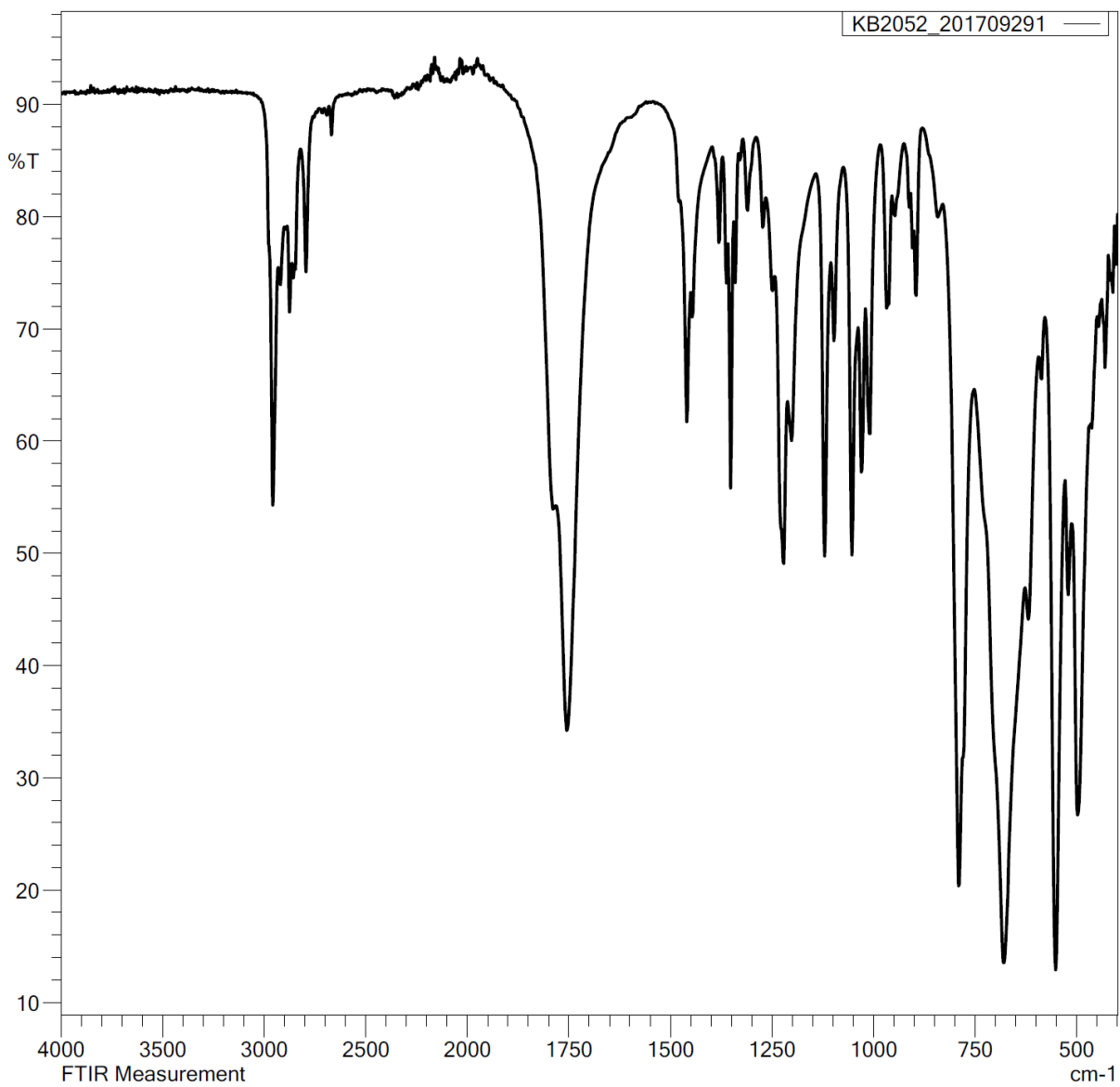


Figure S7: IR spectrum of $\text{H}_2\text{Al}[(\text{tBuN})\text{CH}_2\text{CH}_2(\text{NC}_4\text{H}_8)]$ (2).

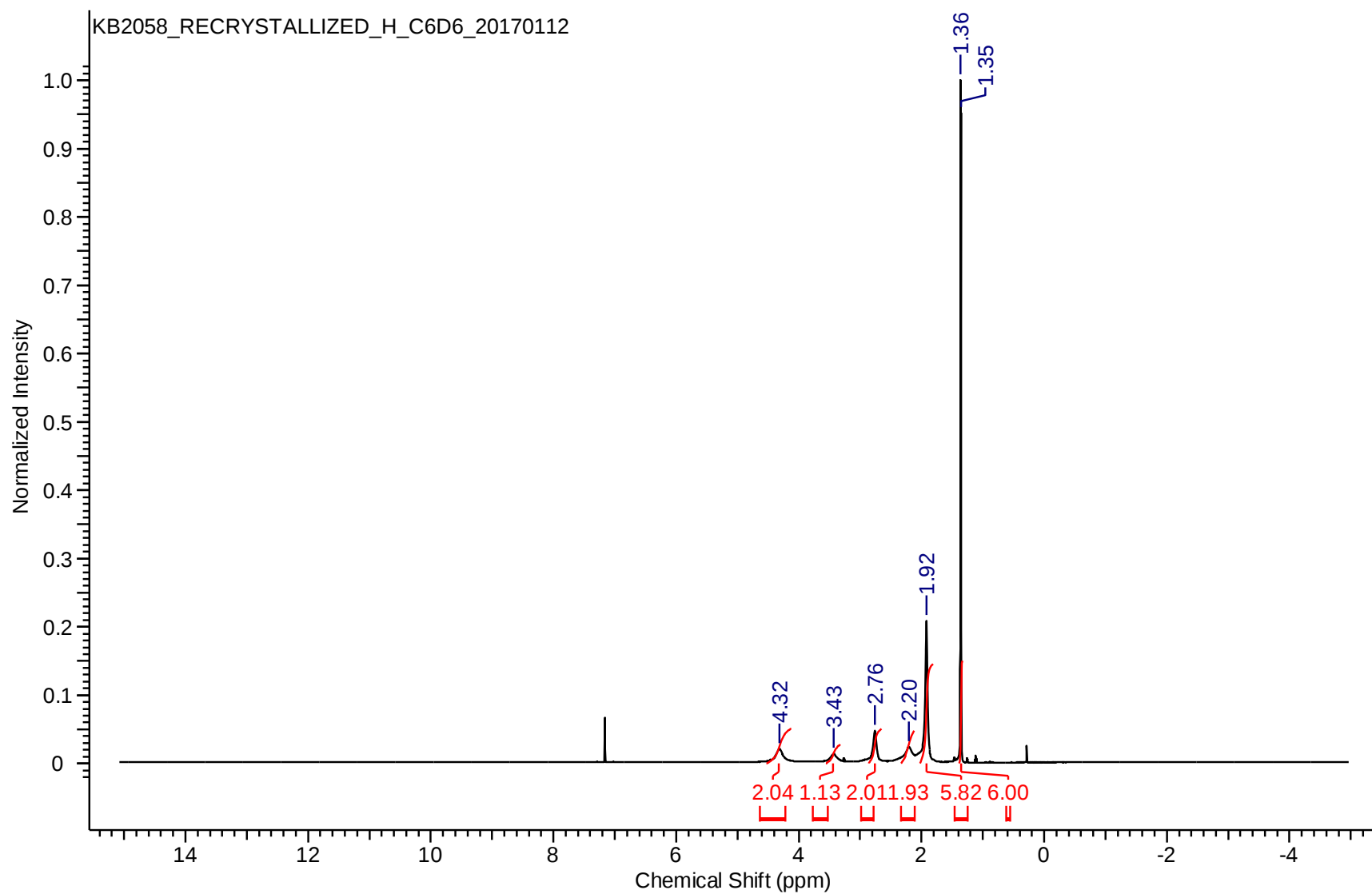


Figure S8: ^1H NMR spectrum of $\text{H}_2\text{Al}[(\text{iPrN})\text{CH}_2\text{CH}_2(\text{NMe}_2)]$ (**3**).

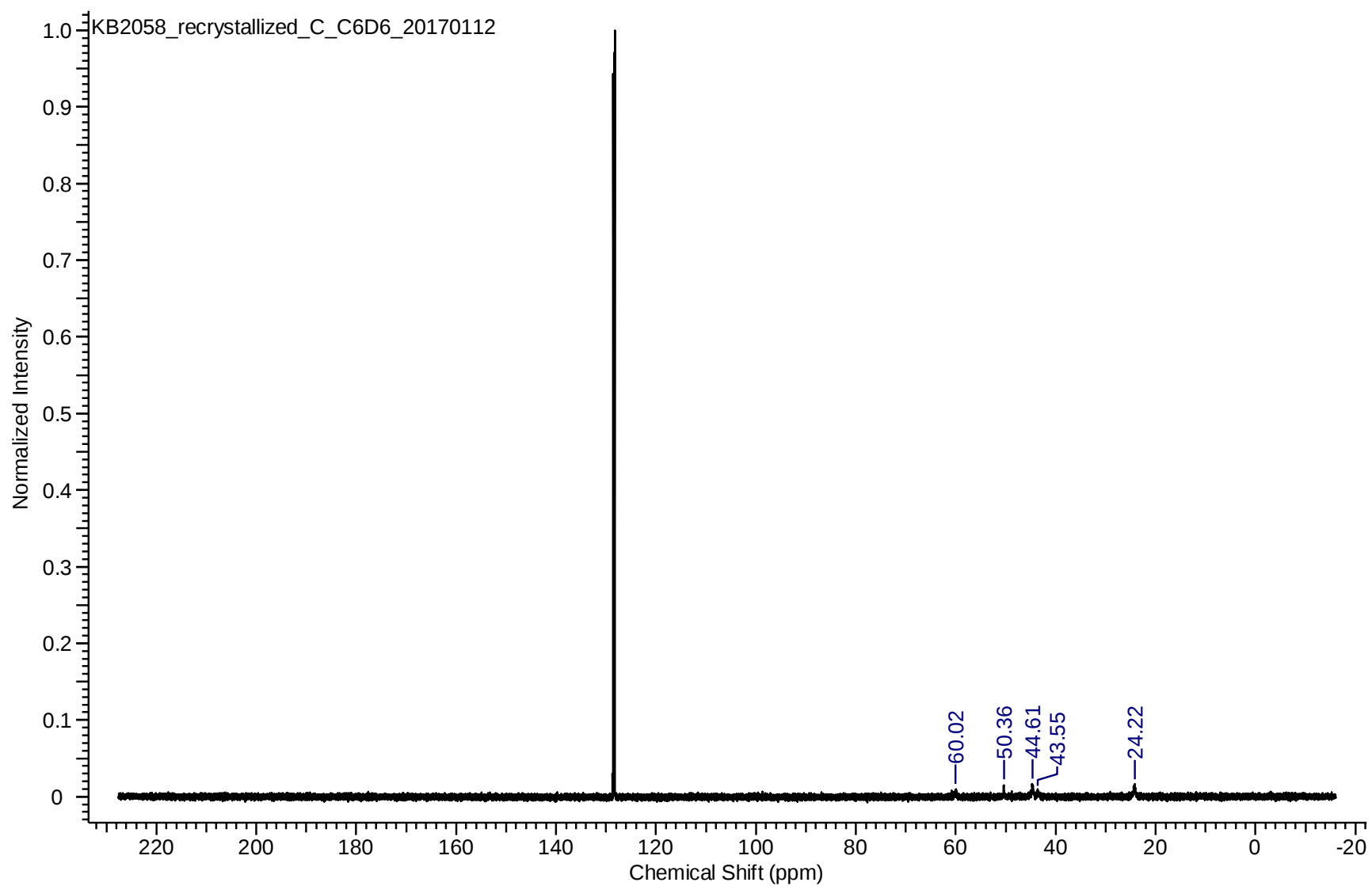


Figure S9: ^{13}C NMR spectrum of $\text{H}_2\text{Al}[(\text{iPrN})\text{CH}_2\text{CH}_2(\text{NMe}_2)]$ (**3**).

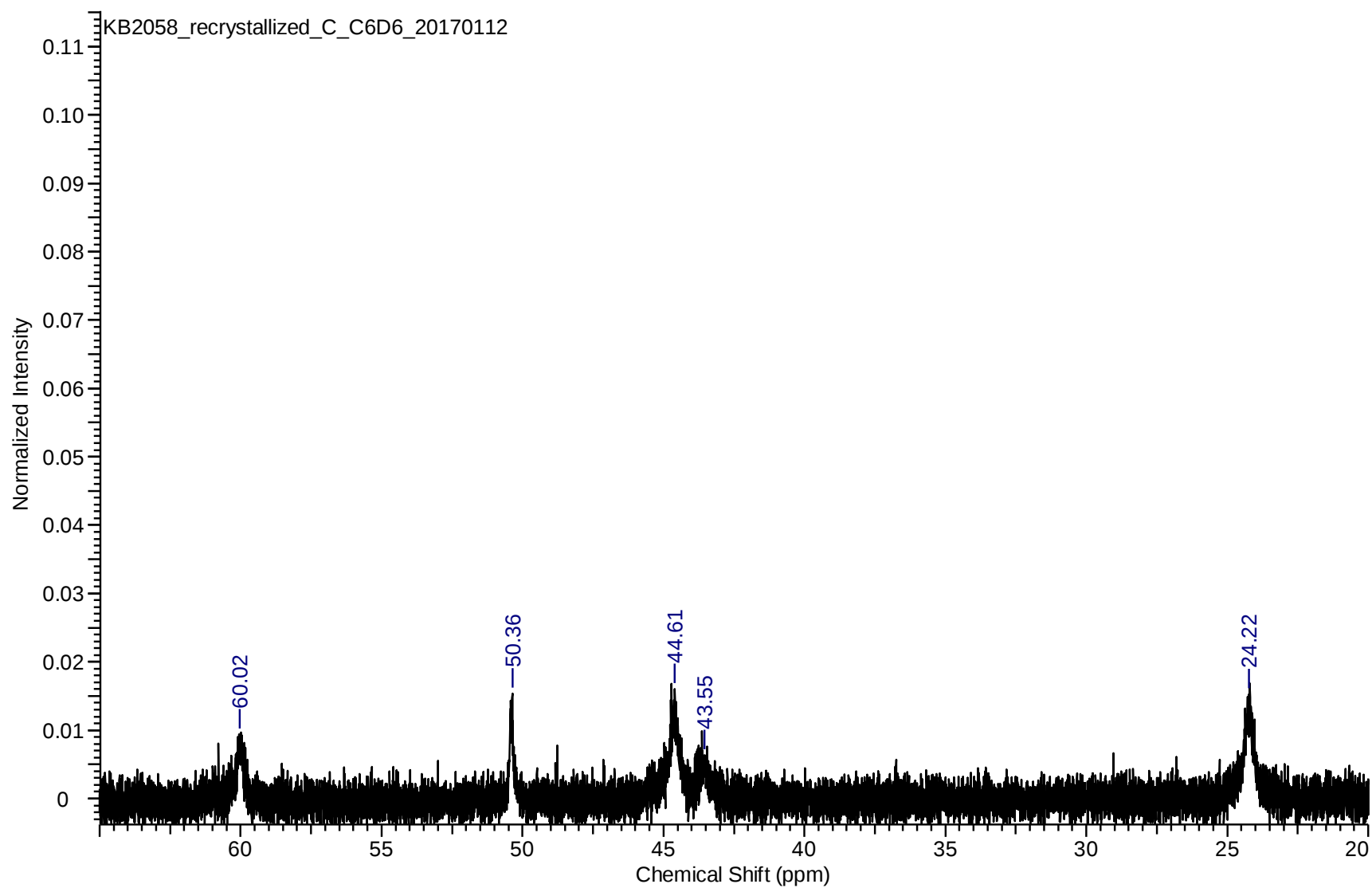


Figure S10: Zoomed-in ^{13}C NMR spectrum of $\text{H}_2\text{Al}[(\text{iPrN})\text{CH}_2\text{CH}_2(\text{NMe}_2)]$ (3).

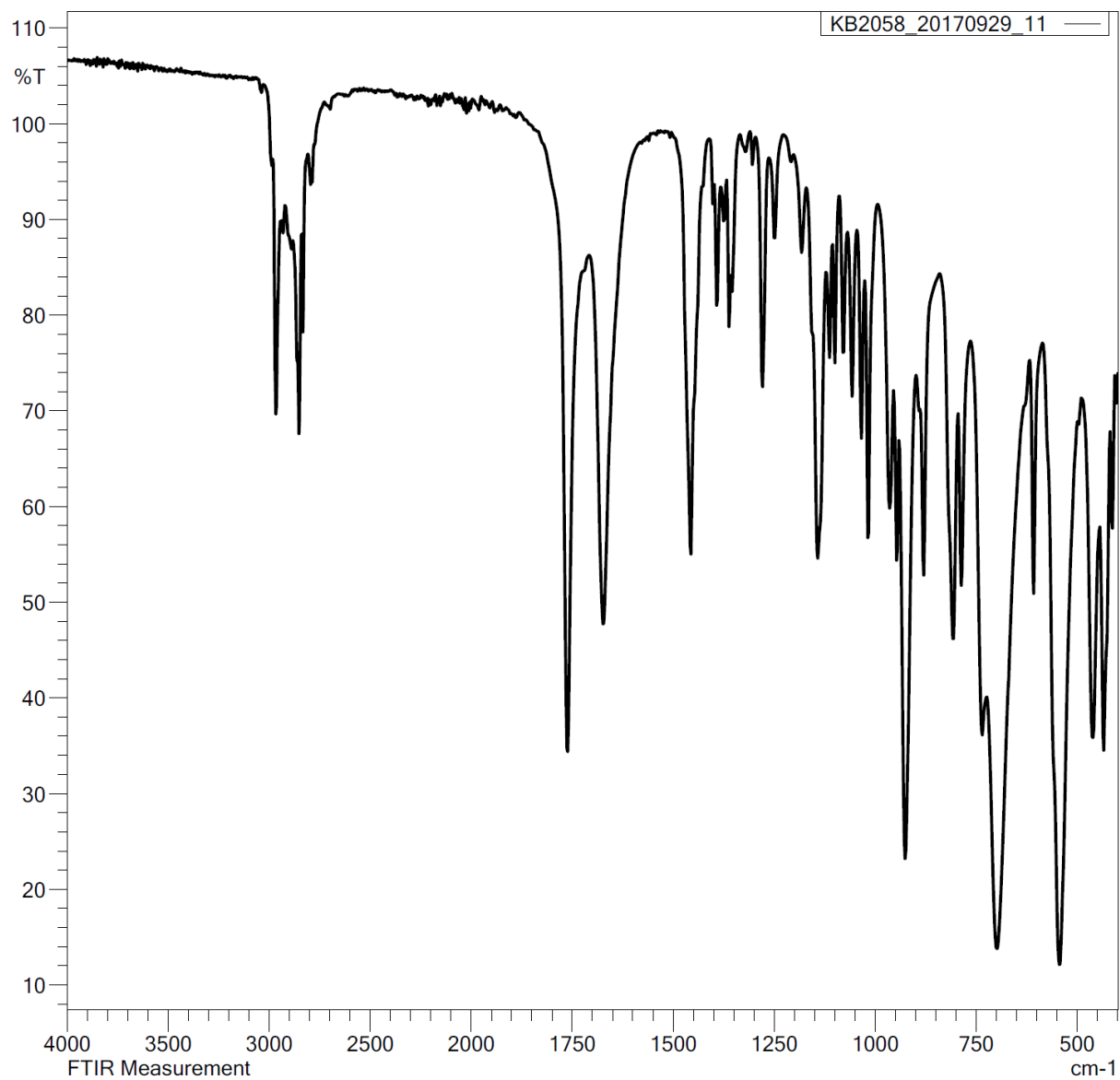


Figure S11: IR spectrum of $\text{H}_2\text{Al}[(\text{iPrN})\text{CH}_2\text{CH}_2(\text{NMe}_2)]$ (**3**).

2. SEM Images and EDS Spectra

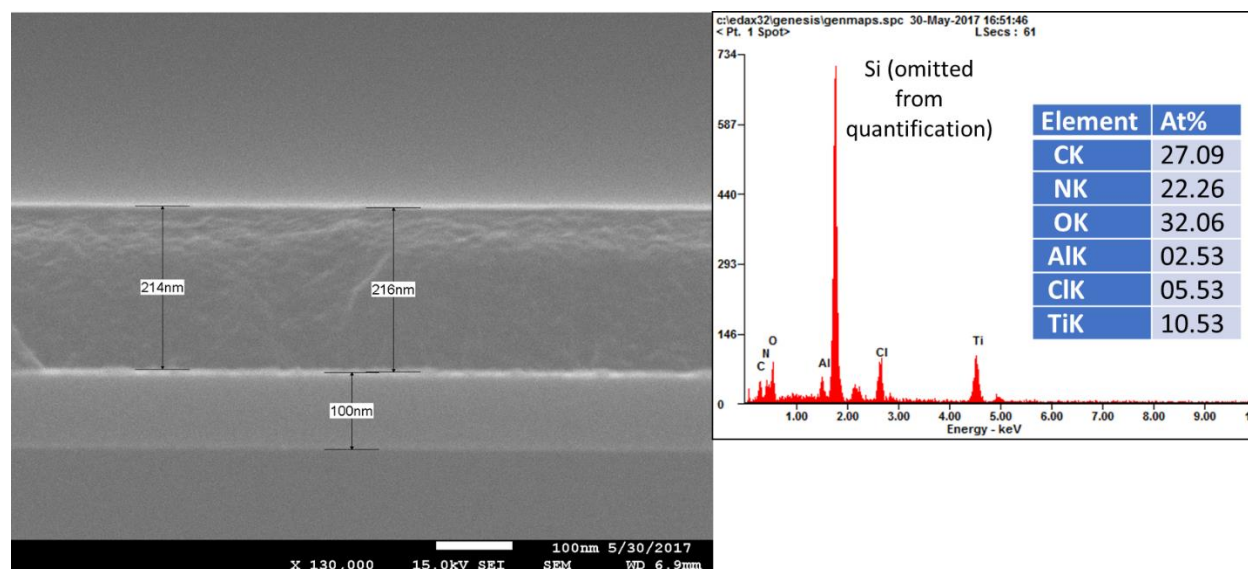


Figure S12: SEM image and EDS analysis of a film deposited from TiCl_4 and **1** at 150 °C after 500 cycles.

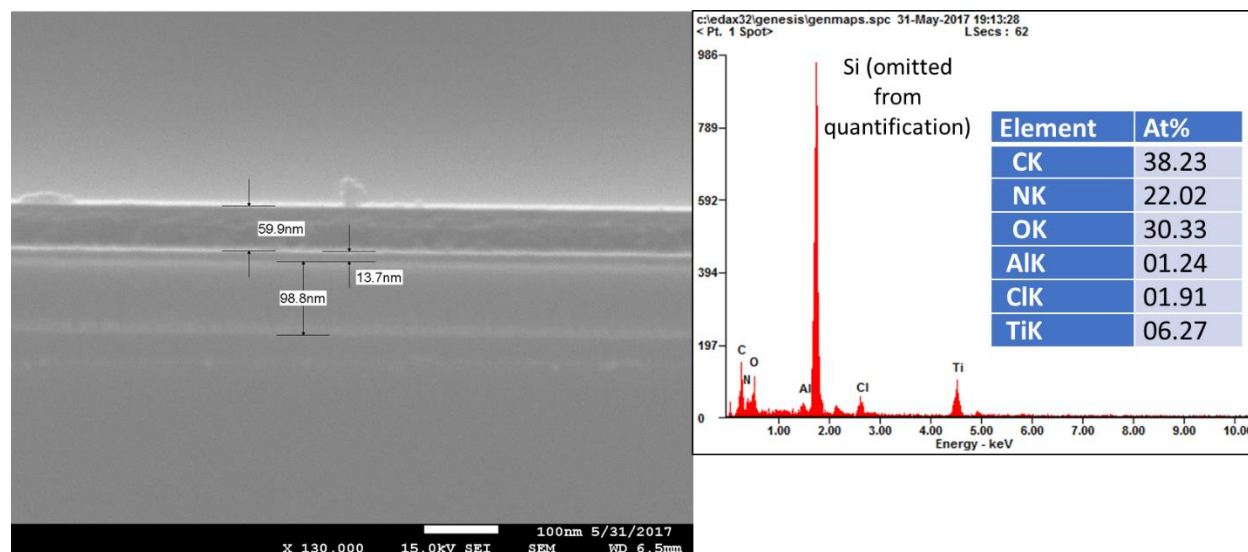


Figure S12: SEM image and EDS analysis of a film deposited from TiCl_4 and **1** at 180 °C after 200 cycles.

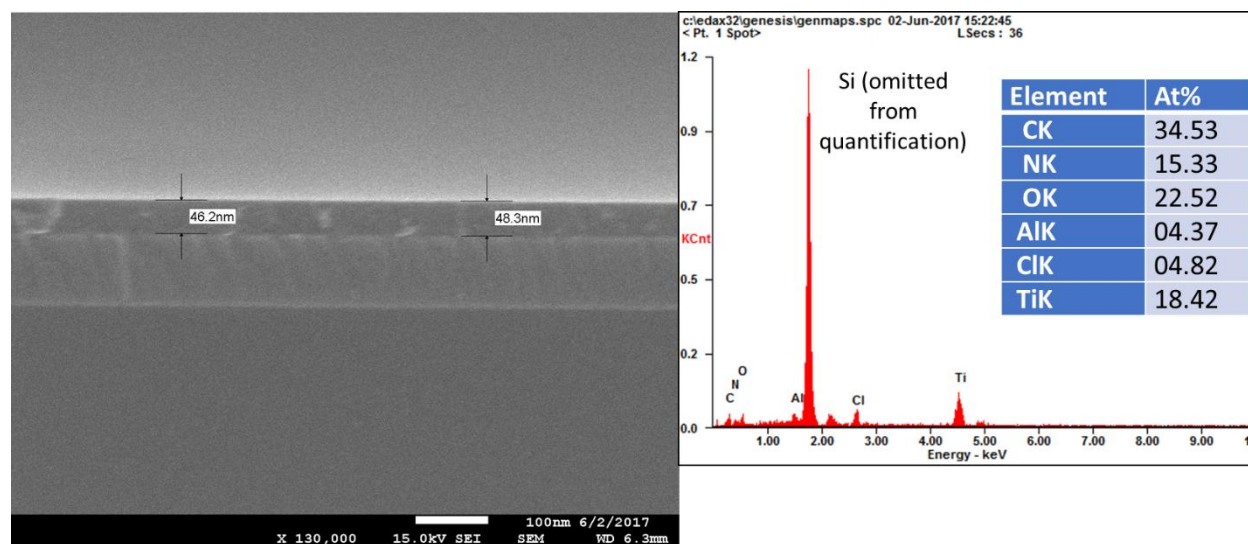


Figure S13: SEM image and EDS analysis of a film deposited from TiCl_4 and **1** at 240 °C after 250 cycles.

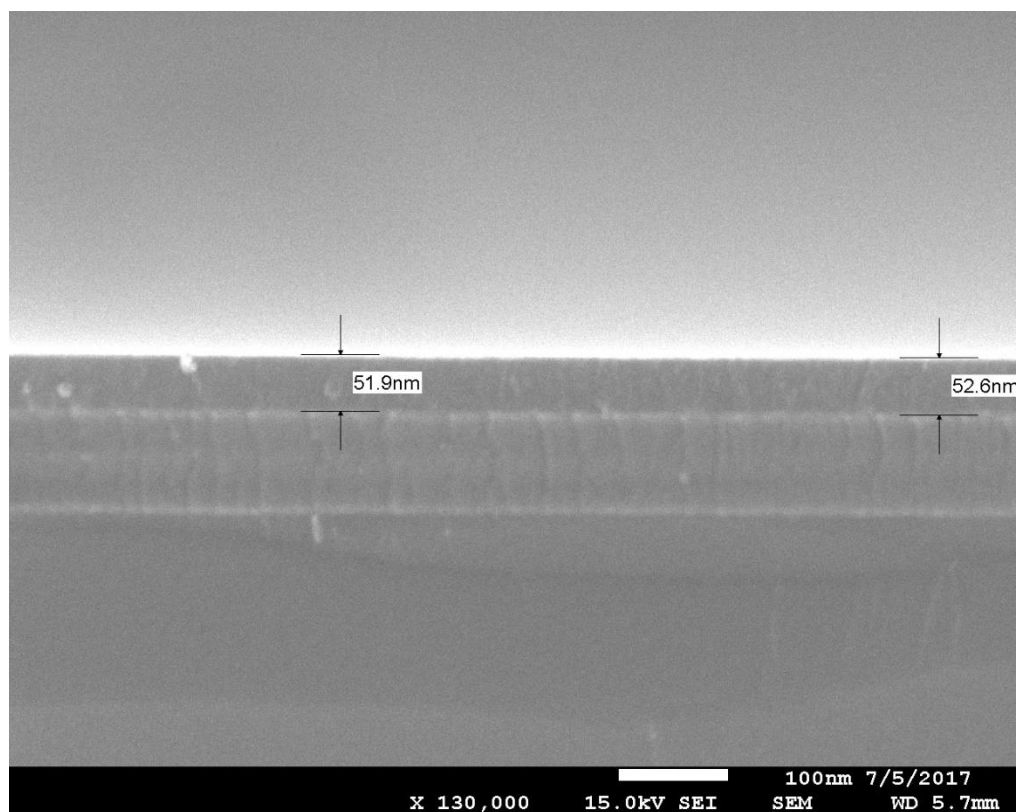


Figure S14: SEM image and EDS analysis of a film deposited from TiCl_4 and **2** at 300 °C after 250 cycles.

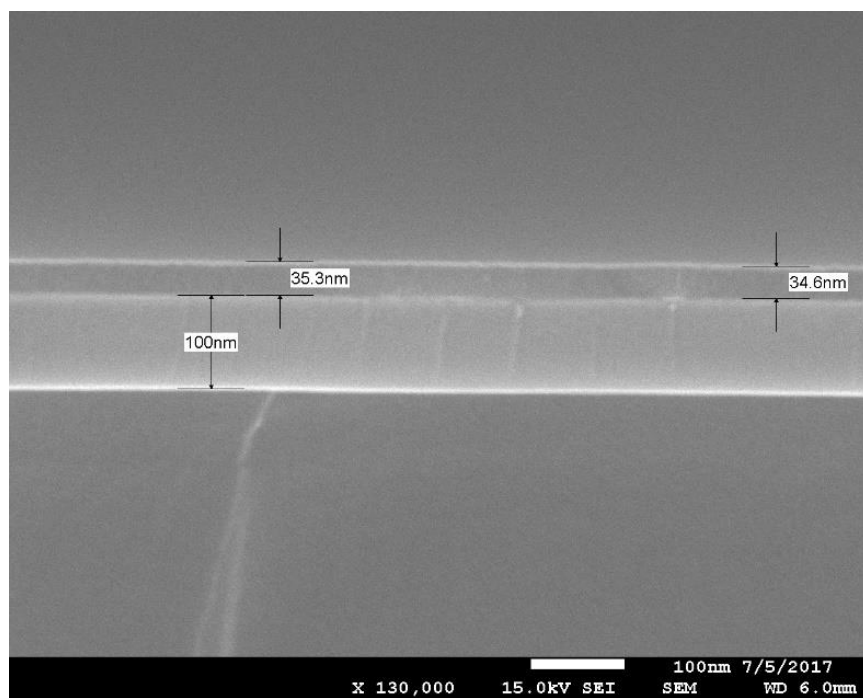


Figure S15: SEM image of a film deposited from TiCl_4 and **4** at $300\text{ }^\circ\text{C}$ after 250 cycles.

3. Additional XPS Spectra

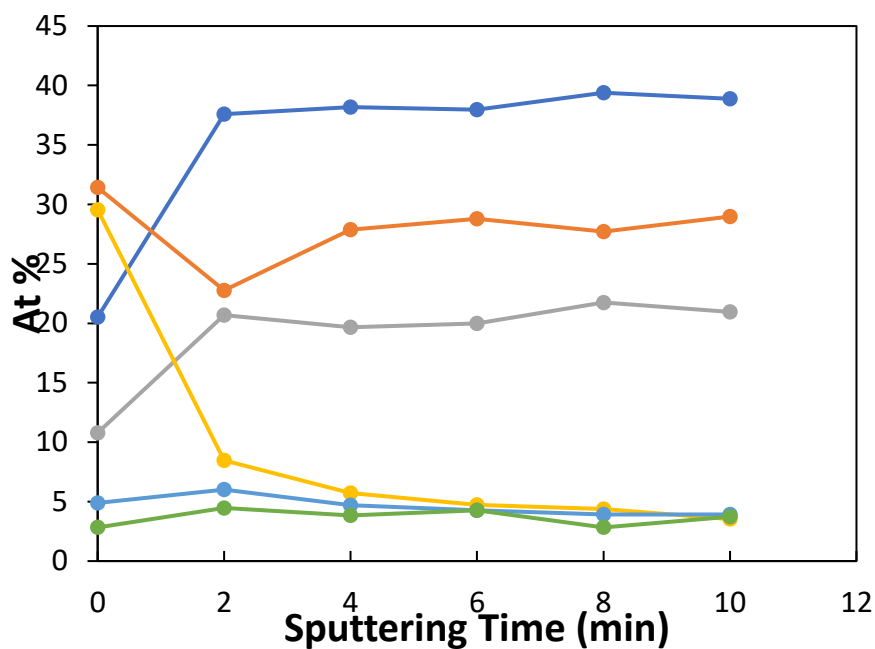


Figure S16: XPS depth profile of a film deposited from TiCl_4 and **1** at 300 °C after 250 cycles.

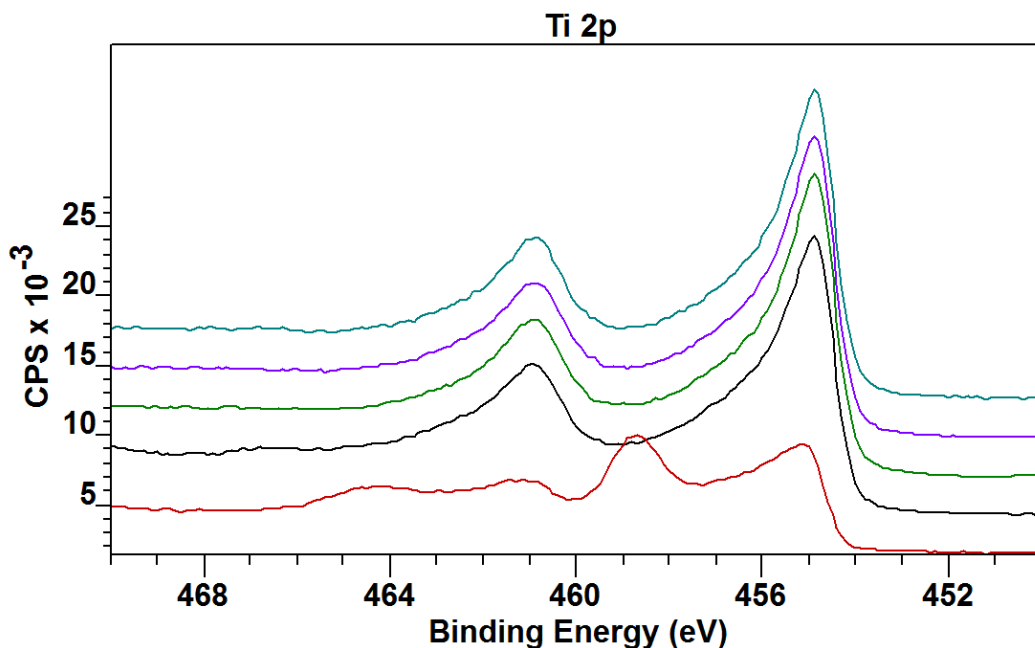


Figure S17: XPS Ti 2p region of a film deposited from TiCl_4 and **1** at 300 °C after 250 cycles. The bottom (red) spectrum was collected before Ar ion sputtering and the other spectra were collected after 2, 4, 6, and 8 min of sputtering.

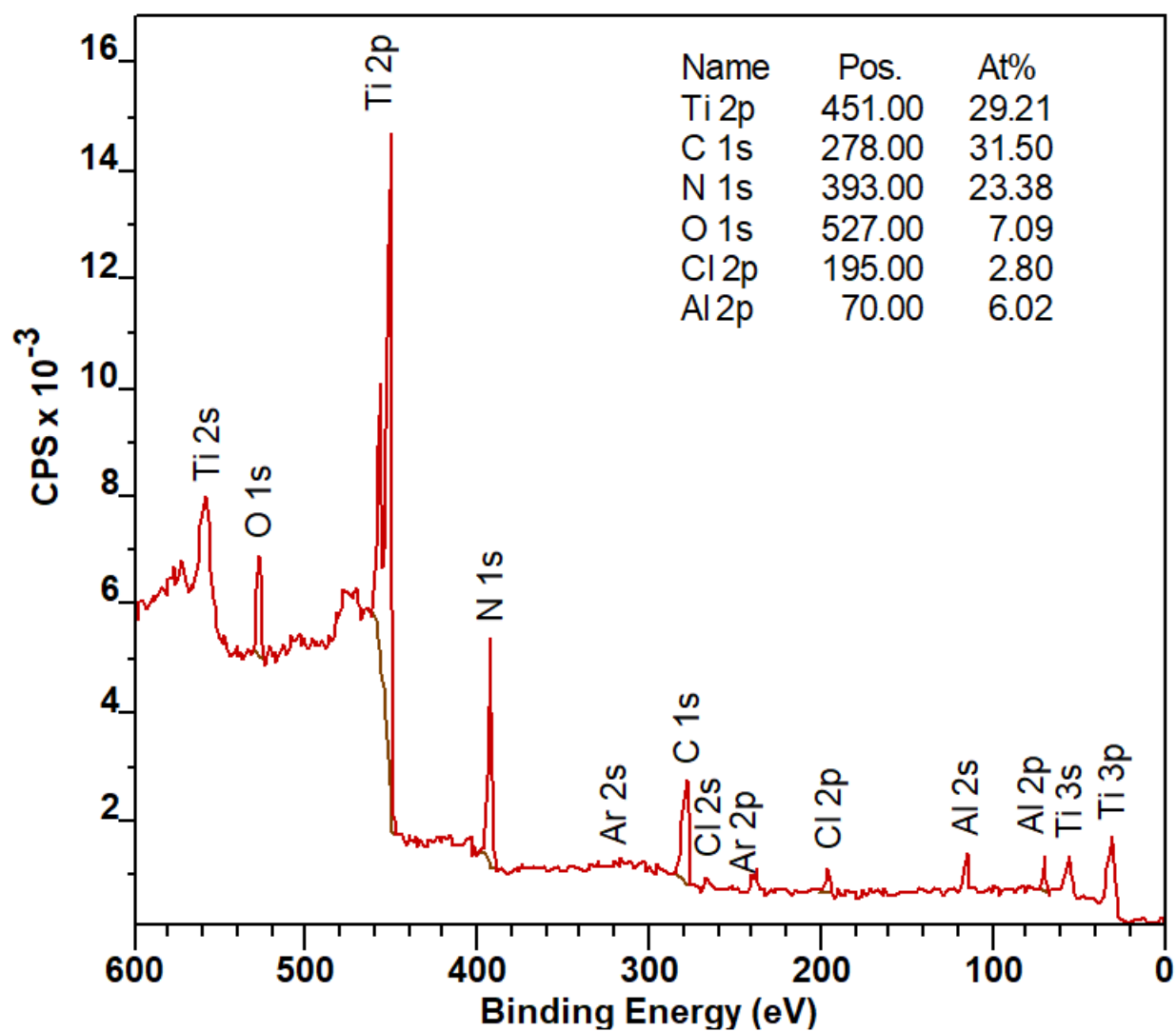


Figure S18: XPS survey spectrum of a film deposited from TiCl_4 and **1** at 400 °C after 250 cycles.

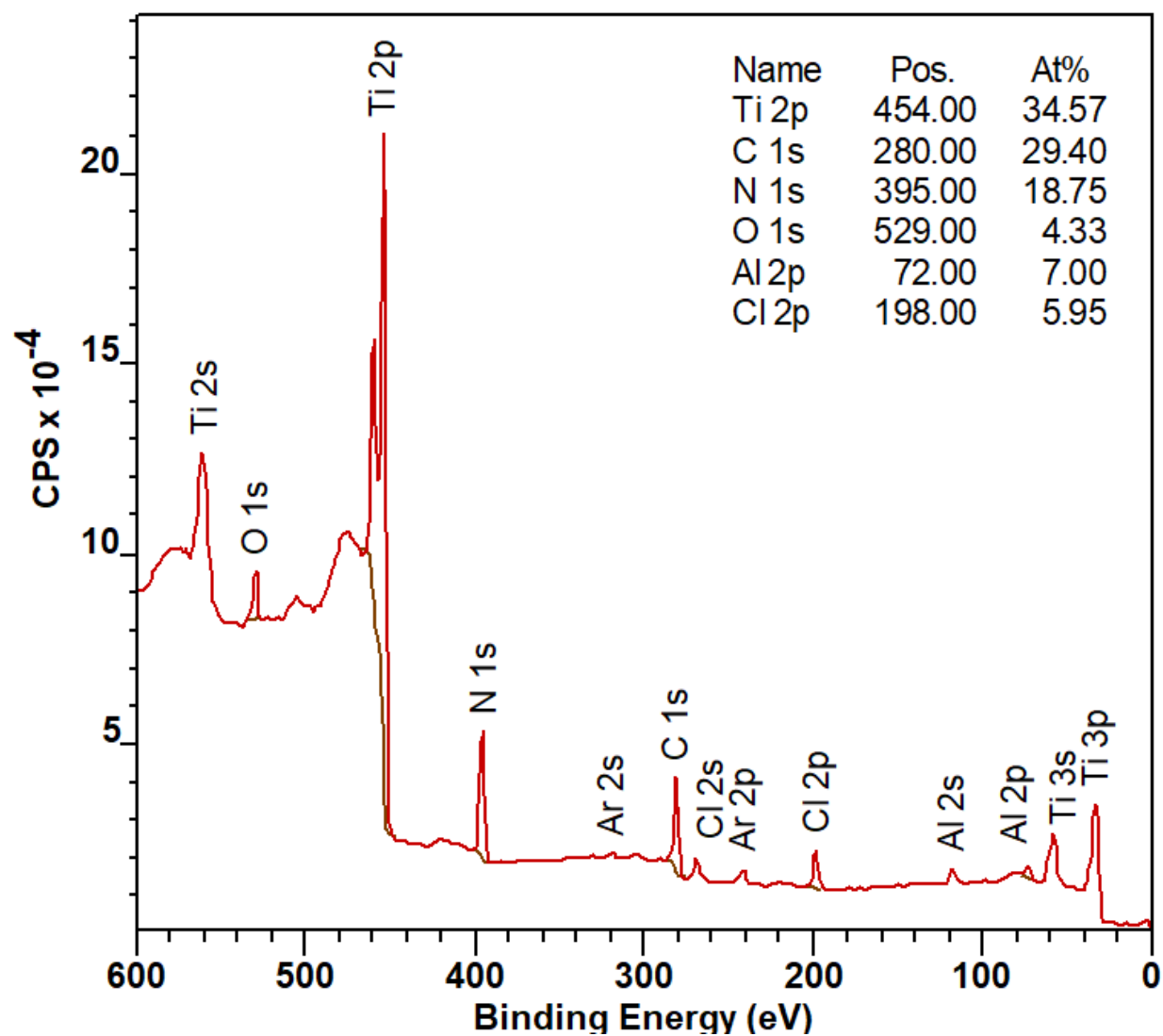


Figure S19: XPS survey spectrum of a film deposited from TiCl_4 and **1** at 300 °C after 300 cycles using Ar carrier gas.

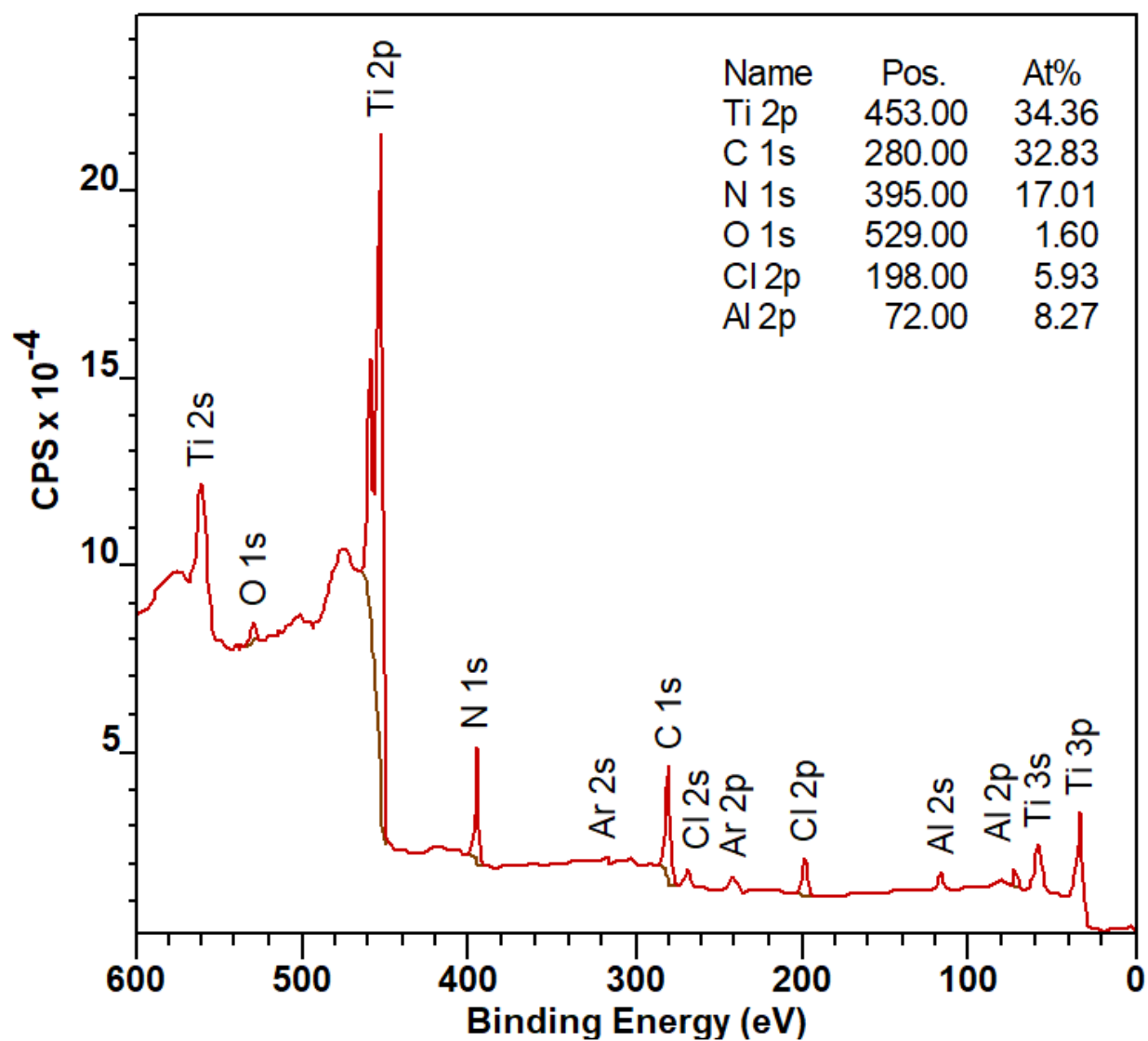


Figure S20: XPS survey spectrum of a film deposited from TiCl_4 and 2 at 300 °C after 250 cycles.

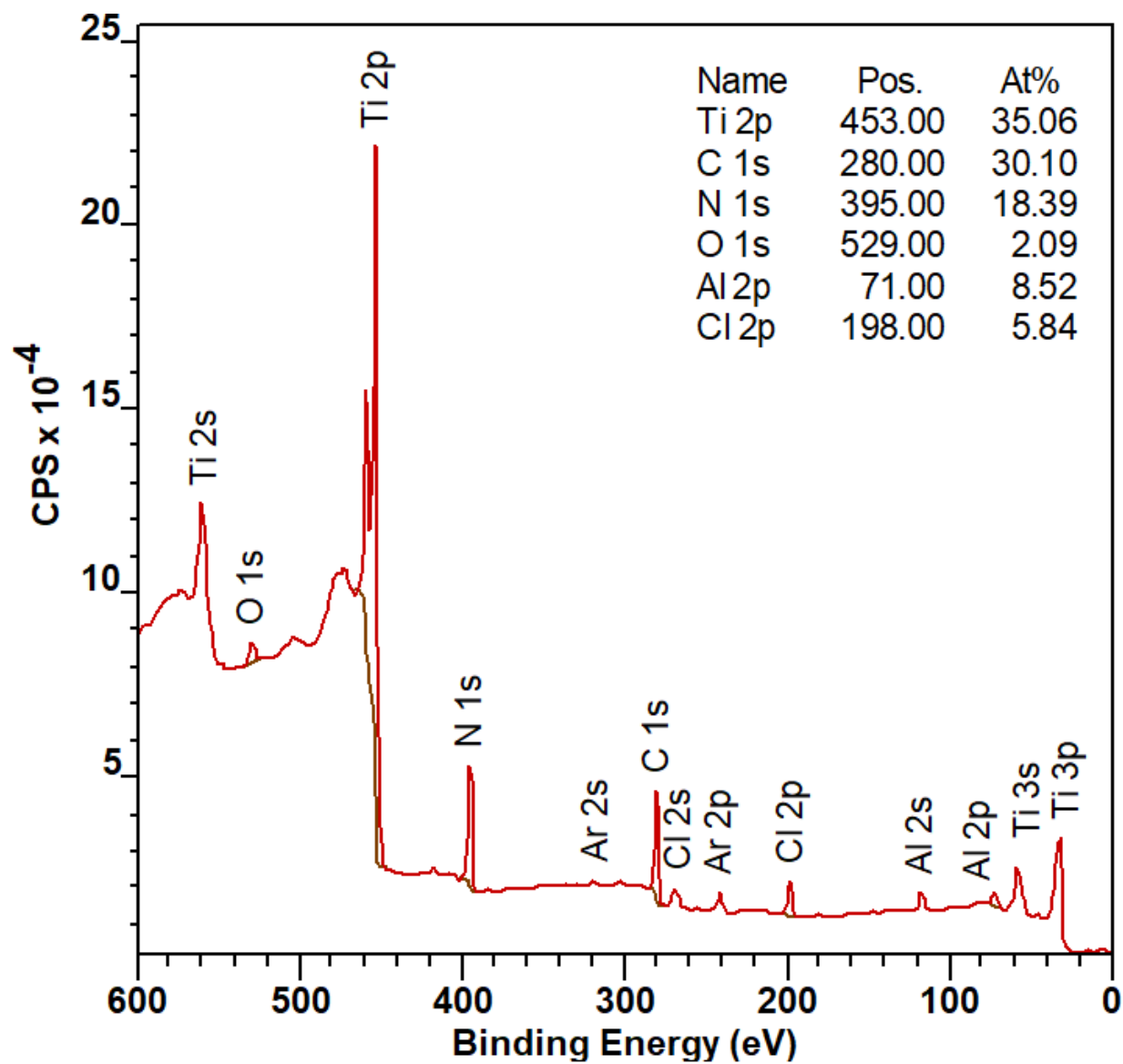


Figure S20: XPS survey spectrum of a film deposited from TiCl_4 and **4** at 300 °C after 300 cycles.