2020「中技社科技獎學金」

2020 CTCI Foundation Science and Technology Scholarship

研究獎學金

Research Scholarship

以金屬矽化物和鍺化物實現低接觸電阻率之下一代元件

Realizing Low Contact Resistivity by Metal Silicide and Germanide for Application on Next Generation Device

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研究重點

My research focuses on the development of metal semiconductor technology with low contact resistivity which is divided into two parts: ALD-Co silicide (part I) and ALD-Co germanide (part II). Part I, ALD-Co silicide is found that most excellent contact resistivity of 1.0×10^{-8} Ω-cm^2 can be achieved due to enhanced crystallinity in $CoSi_2$ phase by RTA at 750 ˚C. Based same RTA temperature to compare PVD-Co silicide, ALD-Co silicide exhibits reduced contact resistivity by 76 % and it is mainly due to the optimized interface roughness between silicide and Si substrate that makes less roughness induced scattering effect. Part II, ALD-Co germanide was formed by RTA and LTA, respectively which explored its impact on the characteristics of $CoGe_x$ on n^+-Ge. Compared to RTA, LTA exhibits a nearly epitaxial film and a low contact resistivity of 1.3×10^{-8} Ω-cm^2. The promising results can be attributed to the low thermal budget with significant thermal gradient/shallow heat distribution of LTA, proving the eligibility of the contact technology beyond 5 nm node.

研究成果-Silicide

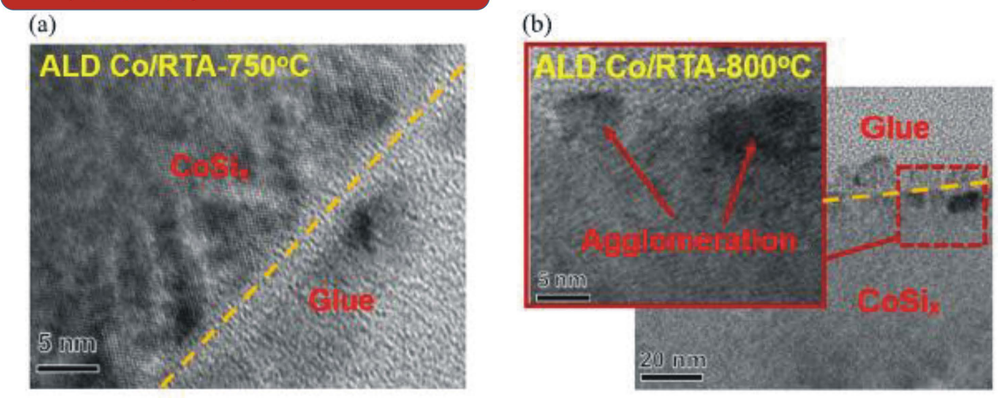

Fig. TEM image of ALD-Co based silicide formed by RTA at (a) 750 °C and (b) 800 °C.

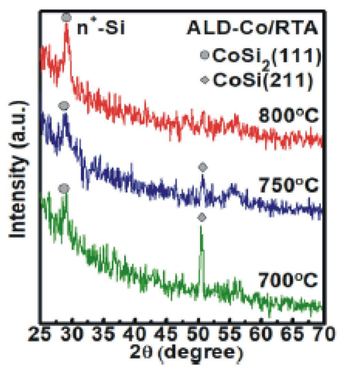

Fig. XRD patterns of ALD-Co based silicide formed by RTA at various RTA temperatures.

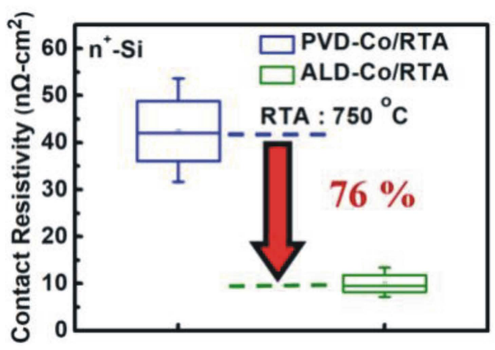

Fig. Contact resistivity of PVD-Co and ALD-Co based silicide formed by RTA at 750 °C.

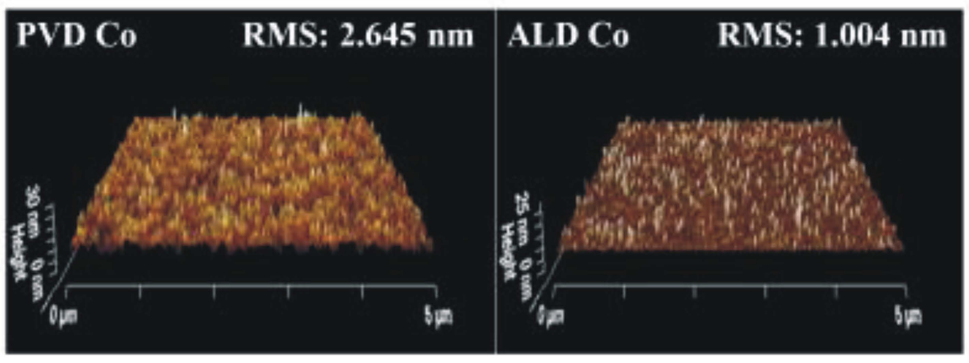

Fig. Comparison of AFM topology of Si surface after stripping Co silicide formed by PVD and ALD Co with RTA at 750 °C.

研究成果-Germanide

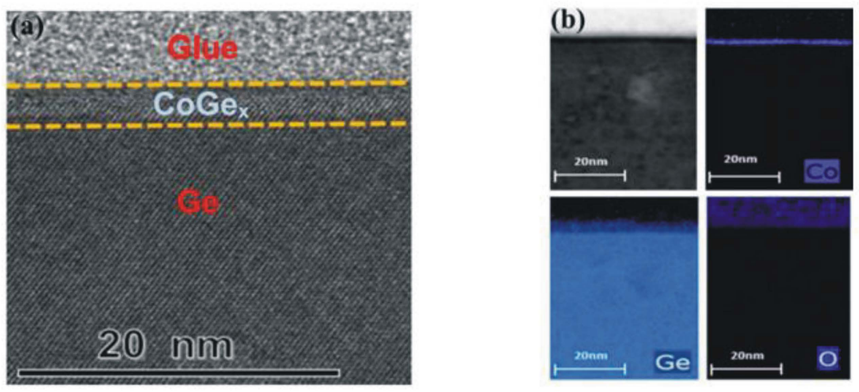

Fig. (a) cross-sectional TEM image and (b) Ge, Co and O mapping by EDS analysis of Co germanide/n^+-Ge formed by ALD Co with LTA of 0.1 J/cm^2.

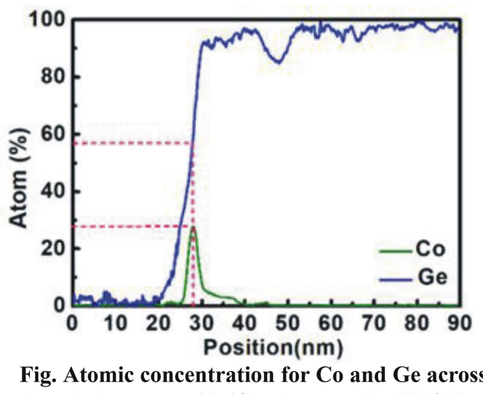

Fig. Atomic concentration for Co and Ge across the whole germanide/Ge structure by EDS line scan.

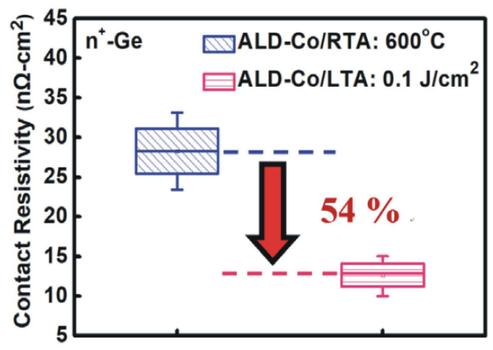

Fig. Contact resistivity of Co germanide formed by ALD Co with LTA of 0.1 J/cm^2 or RTA of 600 °C.

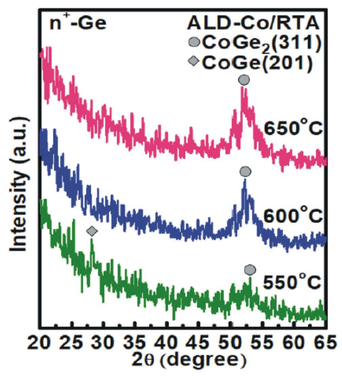

Fig. XRD patterns for ALD-Co based germanide/n^+-Ge by RTA at 550/600/650 °C.

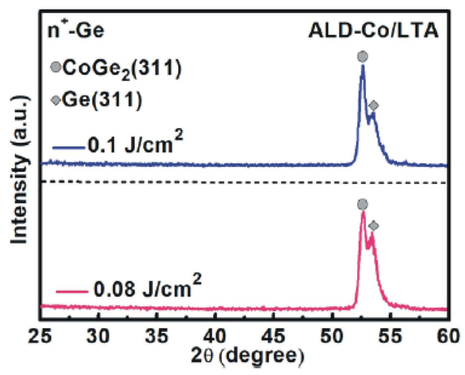

Fig. XRD patterns of germanide formed by ALD Co with LTA of 0.08 and 0.1 J/cm^2.

研究生活與心得

在求學過程中，感謝中技社肯定我在研究所期間的學術成果。學生銘記且感謝指導教授巫勇賢老師悉心的指導與研究上給予的資源，使我在博士班的求學道路上能有實現自我理想的舞台，並展現豐碩的研究成果。除此之外，也感謝研究所一路相伴的實驗室夥伴給予正面能量與歡笑，共創良好的研究環境一同前進與努力。