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Direct Synthesis of Graphene on Niobium and Niobium Nitride

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Direct Synthesis of Graphene on Niobium and Niobium Nitride

Since its isolation by mechanical exfoliation in 2004, graphene has attracted enormous interest from the scientific community not the least because of its unique physical and electronic properties. Among these, graphene's ballistic electron transport and proximity induced superconductivity make graphene-superconductor (GS) hybrid structures a scientifically promising area. Despite the attention it has received, ballistic electron transport in this system remains challenging to study and is still not well characterized. This is often attributed to the difficulty of establishing a highly electron transparent interface between transferred graphene and the superconducting metal. Previous efforts reported in the literature have relied on exotic contacts or annealing with an electric current after transfer in order to improve the interface. Direct growth of graphene on a superconductor however, promises a better interface as well a more scalable process when considering nanoelectronic device fabrication.

This present effort aims at the direct synthesis of few layer graphene on niobium and niobium nitride nanofilms supported on a silicon dioxide substrates. The growth trials were carried out in a plasma enhanced chemical vapor deposition (PECVD) system and characterized by Raman spectroscopy as well as scanning electron microscopy. We report the direct synthesis of graphitic films on both metals in this study using both plasma enhanced as well as purely thermal growth regimes. Future work aims at arriving at a regime that consistently yields few-layer graphene across the bulk of both metals.

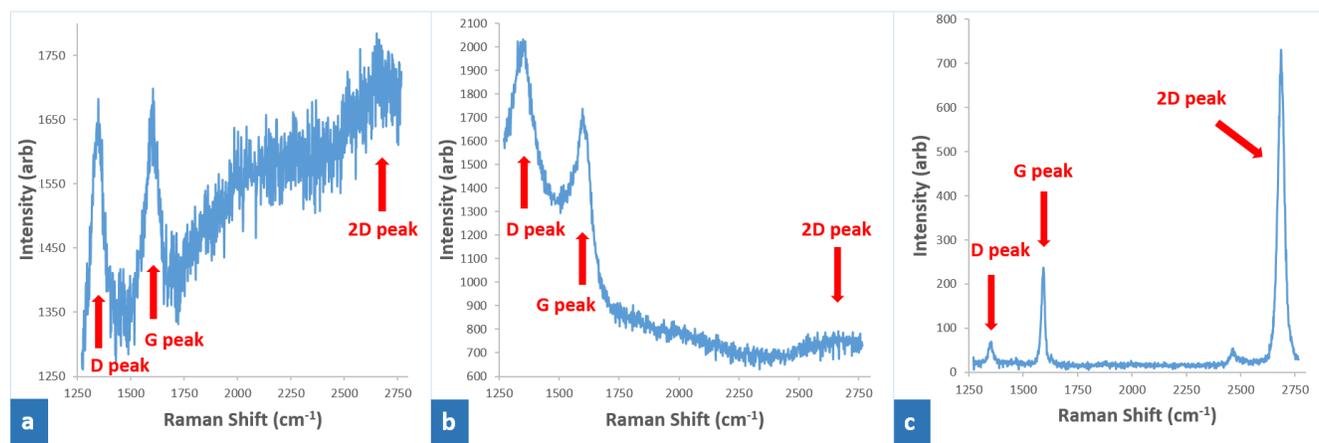


Figure 1. (a) Raman spectrum of graphitic film grown on niobium with labeled D, G and 2D peaks. (b) Raman spectrum of graphitic film grown on niobium nitride. (c) For a comparison, Raman spectrum of monolayer graphene grown on 1.5 micron copper film showing the 2D to G as well as D to G ratios characteristic of high quality graphene.