Superconductivity in atomically thin WS$_2$ from Migdal-Eliashberg study$^1$ APPALAKONDAIAH SAMUDRALA, E. H. HWANG, SKKU Advanced Institute of Nanotechnology (SAINT), Sungkyunkwan University, Suwon-16419, Republic of Korea., E. H. HWANG TEAM — Recently, the possibility of extrinsic superconducting properties and enhancement of the critical temperature ($T_c$) have been widely studied in two dimensional materials such as graphene, phospherene, MoS$_2$ etc. This process includes several approaches such as applying intercalation/adsorption of metal atoms, carrier doping, strain and electric fields to thin 2D materials. In this work, we consider the effects of carrier doping on stability, electron-phonon, and superconductivity of atomically thin WS$_2$. For this, ab initio calculations were performed using Migdal-Eliashberg theory with the combination of Wannier interpolation. From our results, the pristine single layer WS$_2$ is a direct band semiconductor with similar electronic properties of MoS$_2$. Employing carrier doping makes WS$_2$ have the metallic nature, and doping enhances the electron-phonon coupling strength(from $\alpha^2 F(\omega)$) is from 0.3 to 1.5 as doping levels change from 0.02 to 0.10 per formula unit. This trend gives rise to the enhancement of superconducting $T_c$ from 2K to above 10K by electron doping. Overall, present results indicated that the approximate tuning of electronic band structure results possibility of phonon mediated supercomputing properties in atomically thin single layer WS$_2$.

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