STM/STS Observation on Layered Nitride Superconductor α-$(H_2N$-$(CH_2)_{10}$-$NH_2)_x$TiNCl

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Layered nitride MNCl (M=Ti, Zr, Hf) becomes superconducting with its T_cs up to as high as 25.5 K. This can be attained by electron doping to MN double layers through the intercalation of alkali-metals and/or inorganic molecules. Generally, the T_c of such a compound is known to proportional to the inter-layer spacing, which is expanded by the intercalated molecules. However, very recently, the interesting properties were discovered, namely, liner-alkyldiamine intercalated compounds α-$(H_2N$-$(CH_2)_n$-$NH_2)_x$TiNCl show non-monotonic change of the T_c (*i.e.* higher T_c with even number of n) without any remarkable change of the inter-layer spacing. Here, to investigate this interesting phenomenon, we present the scanning tunneling microscopy and spectroscopy (STM/STS) on one kind of these compounds α-$(H_2N$-$(CH_2)_{10}$-$NH_2)_x$TiNCl (n=10, T_c=16 K). The STM/STS measurements were carried out at T=5 K and $P \sim 10^{-8}$ Pa. STM topographies show simple rectangular shaped atomic lattice with the periods of $|\mathbf{a}|$=0.38 nm and $|\mathbf{b}|$=0.33 nm. In spite of the capturing the surface atomic arrangements, the location of the intercalated molecules is not yet identified by our STM observation. The STS results show the averaged gap value of $\Delta \sim 10$ meV, showing an unusually large gap ratio $2\Delta/k_BT_c \simeq 15$. Nevertheless, this value is a common to the one observed before in the α-K_yTiNCl and β-$HfNCl_z$ compounds.