Supplementary Information: Interaction of Langmuir-Blodgett films of Mn_{12} single molecule magnets with superconducting micro-tracks and nano-SQUIDs

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1. Deposition of Langmuir-Blodgett films of SMM

Before making of solution of the mixture of behenic acid (BA) and Mn_{12}-ac, the characteristic vibrational peaks of functional groups of as prepared Mn_{12}-ac and the purchased BA powders have been checked using Fourier-transform infrared (FTIR) spectroscopy. Figure S1 shows the FTIR spectra of Mn_{12}-ac and purchased BA. Different vibrational modes have been marked according to the previous reports.[1,2] Figure S2(a) shows the complete isotherm of BA molecules floats on the subphase i.e., the variation of surface pressure (SP) with mean molecular area (Mma) has been shown. The two-dimensional analogue of a pressure is called SP and $SP = \gamma - \gamma_0$ where γ is the surface tension of subphase in the absence of monolayer and γ_0 is the surface tension in the presence of monolayer.

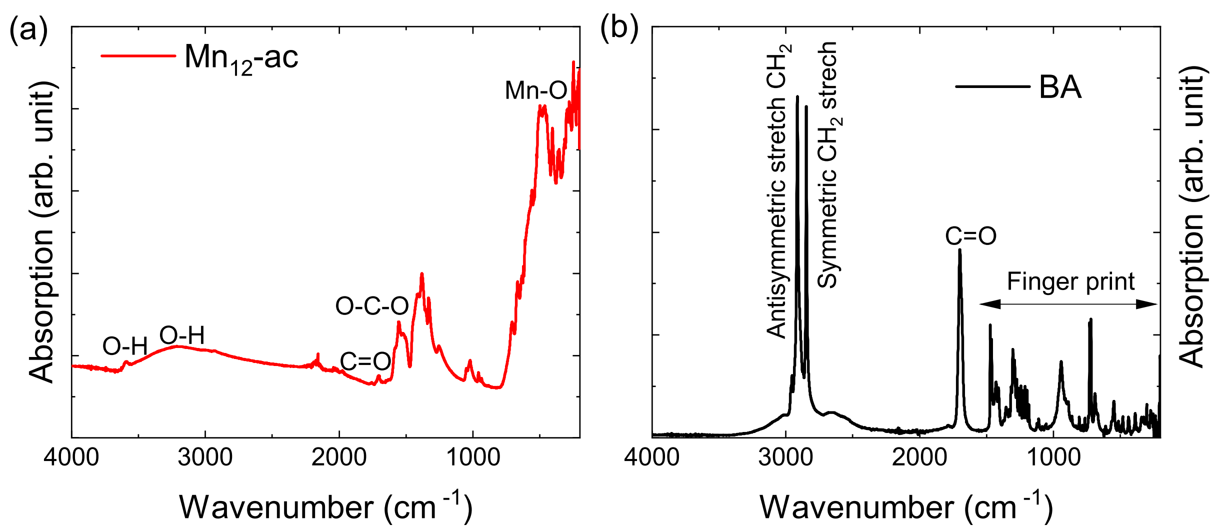

Figure S1: Fourier transform infrared spectroscopy spectra of (a) Mn_{12}-ac powder and (b) behenic acid showing different vibrational modes' peaks and reveals the identity.

Distinctive regions of the isotherm curve represent the different states of BA formed during the compression of the two symmetric barriers with a constant speed of 3 mm/min (Fig S2(a)). The SP remains close to zero up to 26 Å^2 as the Mma decreases by compressing the barriers which represents the gaseous state of BA molecules. In further compressing the barriers, SP increases with decrease of Mma represents the liquid state of BA. Above liquid

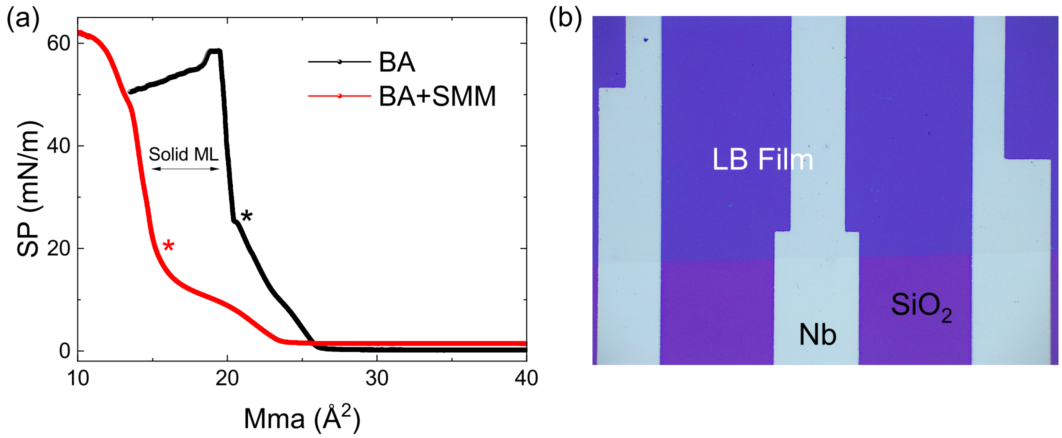

Figure S2: Comparison of complete isotherm (surface pressure (SP) vs mean molecular area (Mma)) of (a) behenic acid (BA) and mixture of BA & Mn_{12}-ac SMM molecules in the 10 : 1 M ratio. The asterisk symbols show the transition from liquid state to solid monolayer state. The sharp linear portions of the curves (arrow mark) represents the solid monolayer (ML) state. (b) Optical image of a three monolayers of LB film of mixture of BA & Mn_{12}-ac SMM grown on a Nb pattern.

state, there is a clear transition from liquid to solid state (black asterisk mark in Fig S2(a)). In the solid phase, the SP increases sharply with the compression of the barriers where the BA acid is in the form of a solid monolayer on the subphase surface (arrow mark in Fig S2(a)). By extrapolating the linear SP line to abscissa (not shown here), the Mma in the solid phase of BA is found to be around 21 $Å^2$. This value is close to the reported value for BA.[3,4] The observed isotherm is similar to the previously reported comparable systems.[5] The isotherm of mixture of BA & Mn_{12}-ac in 10 : 1 M ratio is significantly different to the isotherm of only BA (Fig S2(a)). The liquid state to solid state transition is not sharp in this case (red asterisk mark in Fig S2(a)), which clearly indicates the Mn_{12}-ac has been attached to the hydrophilic head of the BA matrix. The schematic of attachment of SMM molecules to the BA on the subphase surface has been given in the main text (Fig 1(c)). The solid monolayer of mixture of BA & Mn_{12}-ac have been transferred to the substrate at target $SP = 30$ mN/m.[6] The detailed transfer procedures have been elaborated in the main text. Here, we have presented an optical image of LB film of mixture of BA & SMM transferred to a Nb pattern (Fig S2(b)).

2. Superconducting transition in Nb micro-tracks with various SMM layer thickness

In order to verify that the SMM layers affect the transition temperature of the Nb micro-track we have measured the same Nb track after the deposition of 3, 9, 15, and 21 layers of LB film of mixture of BA & SMM. A systematic change in the transition temperature is observed in the Fig S3.

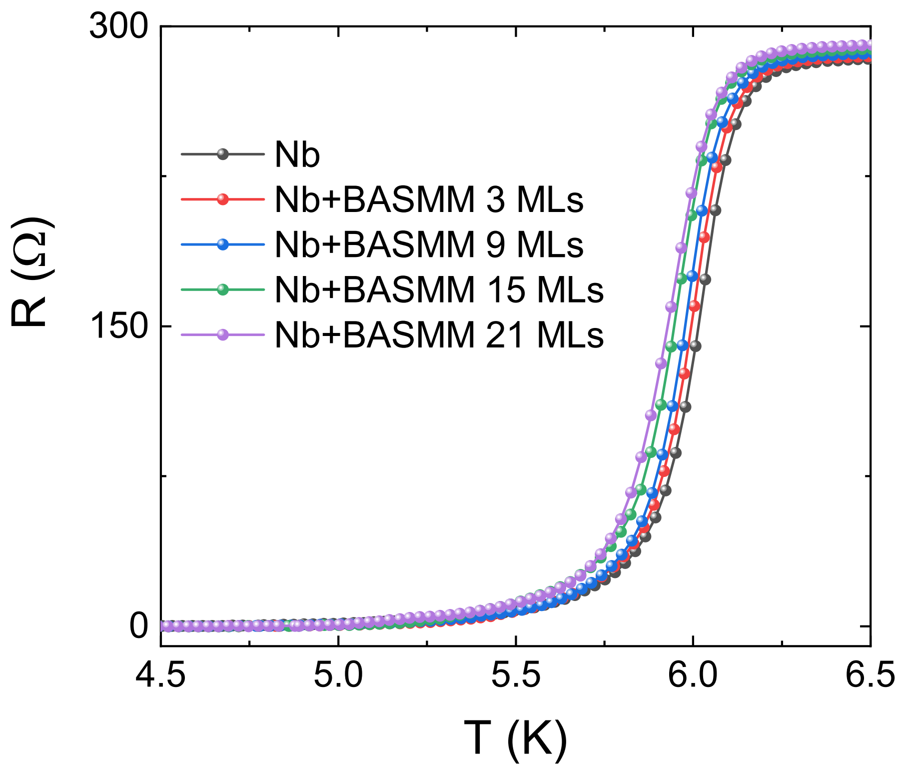

Figure S3: Comparison of temperature dependence of resistance of a bare Nb track and the same Nb track with different LB layers of mixture of BA & SMM showing decrease of critical temperature with increase in the SMM layers.

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