Characterization protocols of highly-dissipative particles:

1- Dissipation capacity (DC): Samples containing high DNA concentrations (> 10 nM) leading to detectable ΔF_{DNA} and ΔD_{DNA} signals, i.e. detectable DNA mass-surface loading, were injected into the sensor device (Fig 1A). Subsequently, changes in dissipation and frequency upon liposome injection were used to calculate the acoustic ratio $\Delta D/\Delta f$ depending on the liposome mass-surface loading. The DC of a certain molecular complex (or particle) has been previously defined as its energy dissipation per unit of mass at the limit of near zero surface coverage, i.e. at the single-molecule level (Fig 1B):

$$DC=\lim(\Delta D/\Delta F)_{\Delta F\to 0}.$$

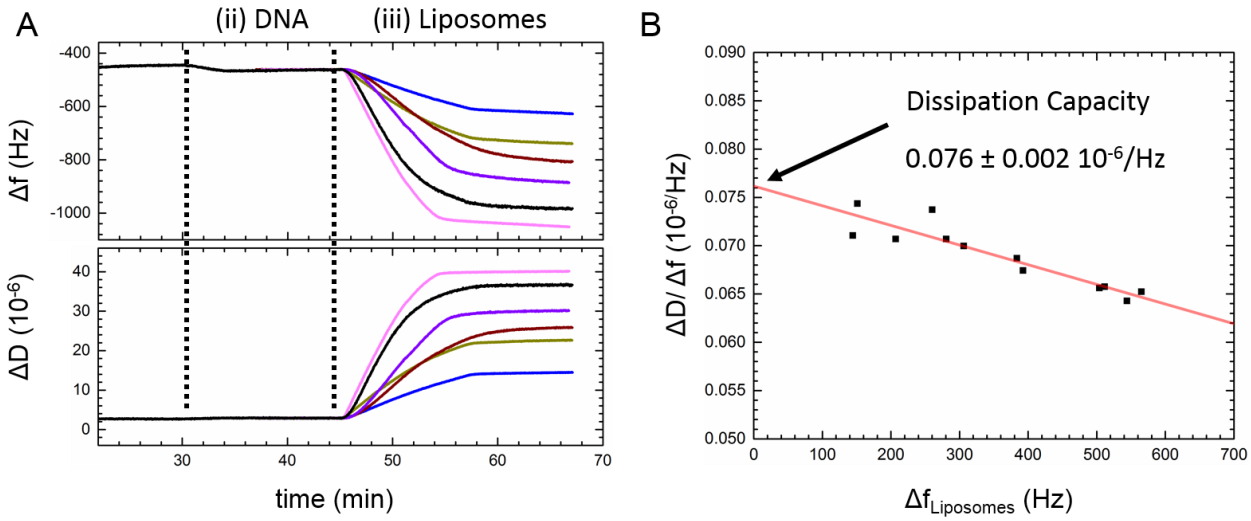

Figure 1. Dissipation capacity (DC) measurement. *Panel (A) shows the real-time acoustic sensograms where changes in frequency Δf (upper panel) and energy dissipation ΔD (lower panel) are recorded upon addition of: (i) neutravidin (not shown for clarity), (ii) DNA at high concentration (e.g. 50 nM), (iii) and liposomes. Several additions of liposomes at different concentrations were performed in ordered to calculate their acoustic dissipation capacity. Panel (B) shows the acoustic ratio (ΔD/Δf) for different amount of liposomes anchored to the acoustic sensor. The dissipation capacity (DC) is defined as the intercept of ΔD/Δf when* $\Delta f_{Liposomes} \to 0$

2- Limit of Detection (LOD). To validate liposomes as dissipative particles capable to enhance DNA detection samples containing low DNA concentrations (< 10 nM) leading to non-detectable ΔF_{DNA} and ΔD_{DNA}, i.e. mass-surface loading below the sensitivity of the acoustic device, were used. Then, ΔD signal was detected upon addition and conjugation of liposomes when the whole DNA-Liposome complex is formed. Then, the limit of detection (LOD) was defined as the lowest detectable DNA concentration injected in the first step (Fig 2).

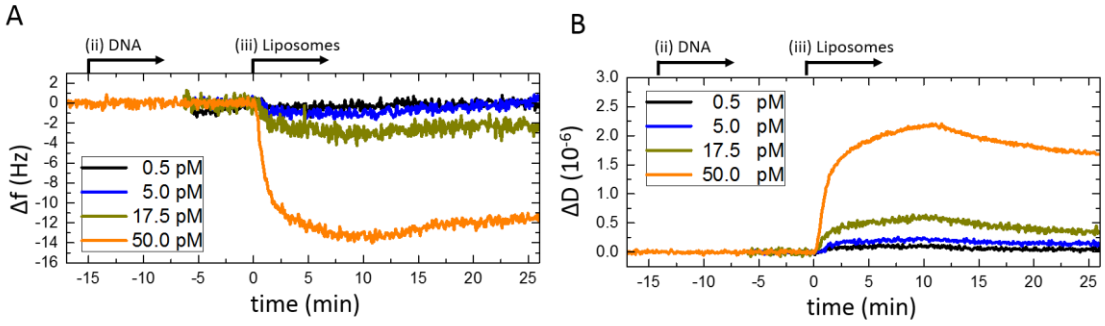

Figure 2. Limit of Detection (LOD) measurement. *Changes in frequency (Δf) and dissipation energy (ΔD) are shown upon (ii) addition of DNA at low concentrations, and (iii) subsequently detected with liposomes. The limit of detection (LOD) is defined as the minimum DNA concentration injected in step (ii) and detected using liposomes in step (iii). Neutravidin layer formation (i) was omitted for clarity.*