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Collective rotation of nanorods in thin films

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Collective rotation of nanorods in thin films

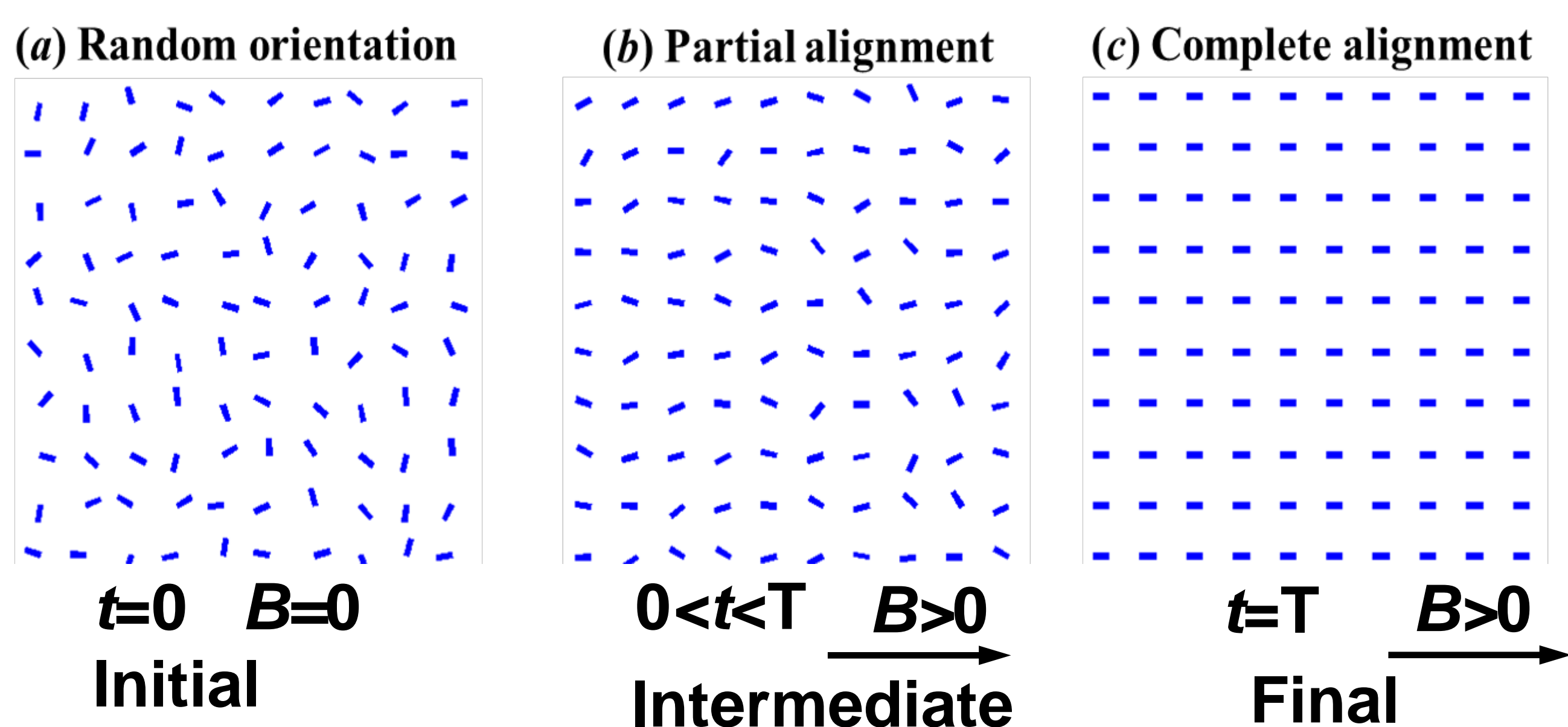
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Objective

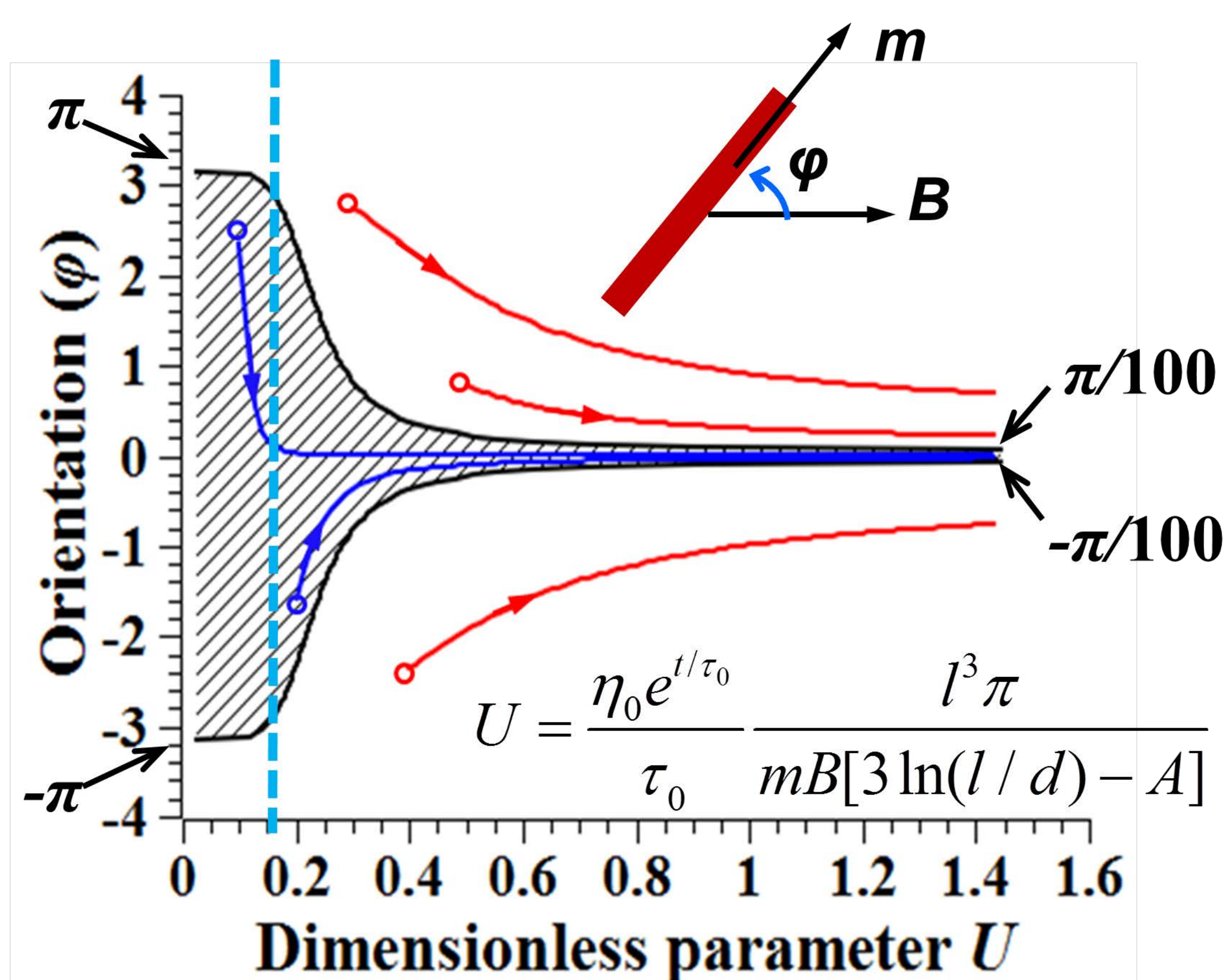
Fabrication of composites ceramic films containing ordered different structures of magnetic nanorods.



Challenge: Viscosity of the precursor dispersion is time dependent. Not all nanorods can be captured by the field. $\eta = \eta_0 \exp(t/\tau_0)$

Can (a) configuration be converted into (c)?

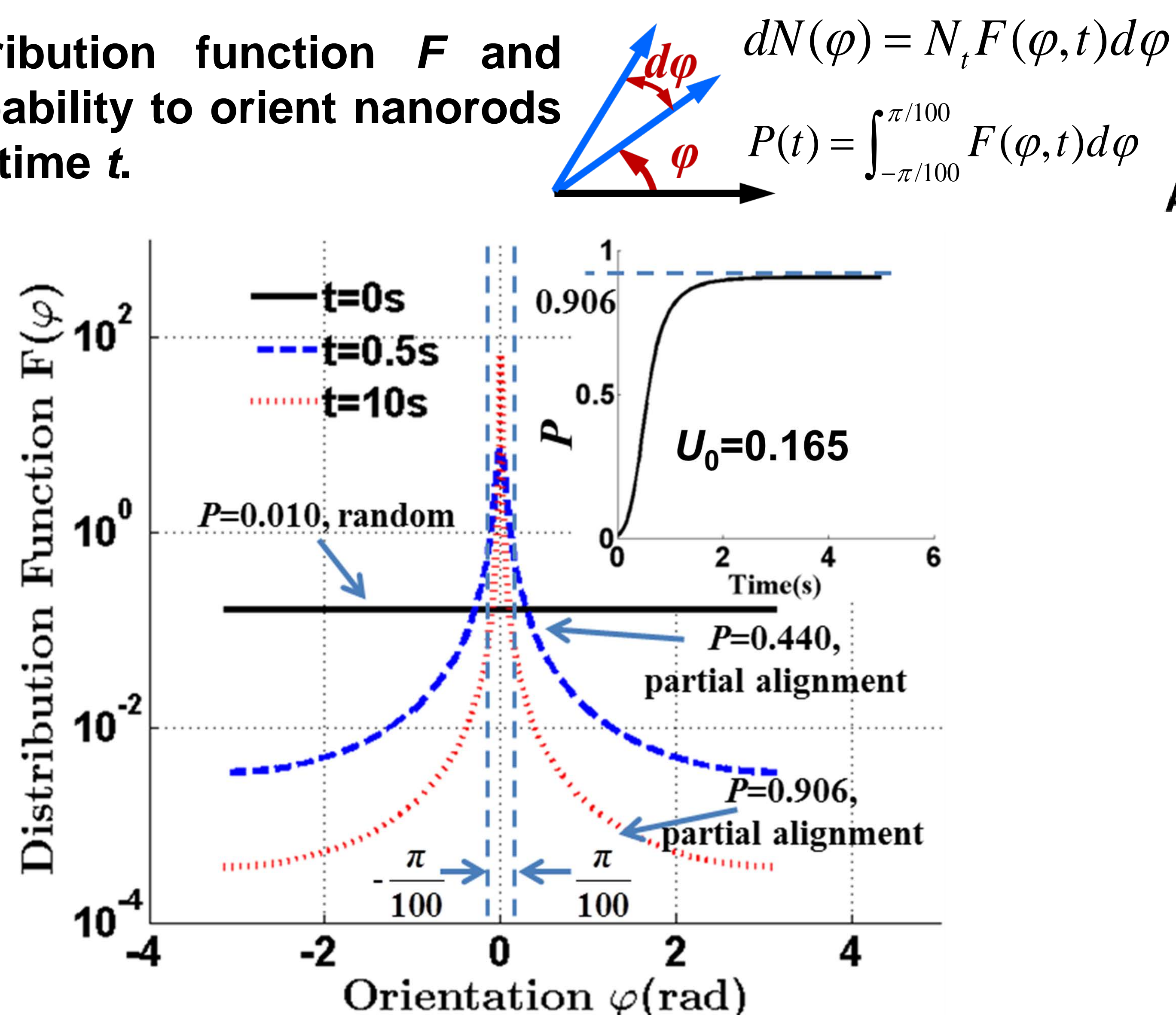
Kinetics of nanorod orientation



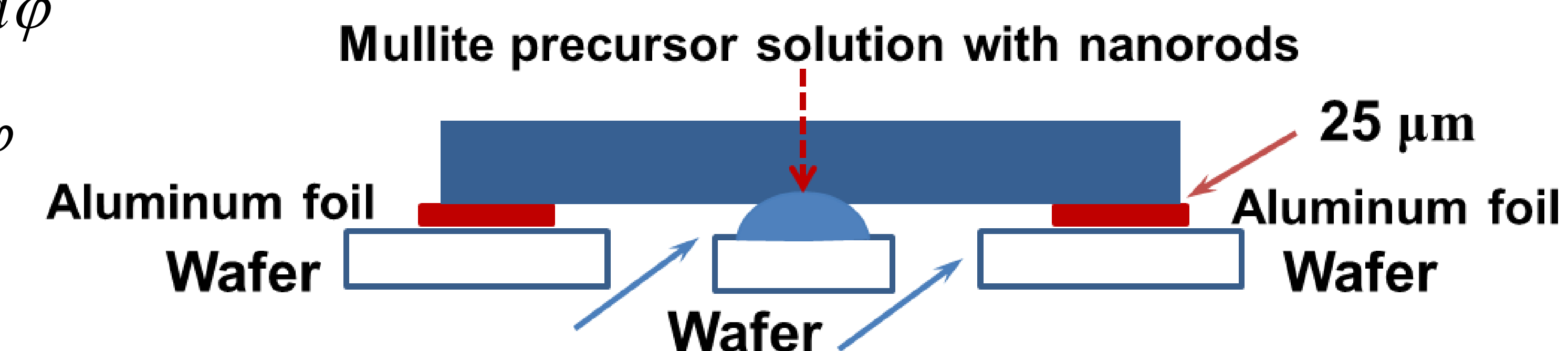
η_0 : Initial viscosity; B : External magnetic field;
 τ_0 : Characteristic time of viscosity increase;
 d : Diameter of nanorod; l : Length of nanorod;
 m : Magnetic moment of nanorod; $A \approx 2.4$

Collective kinetics of nanorods

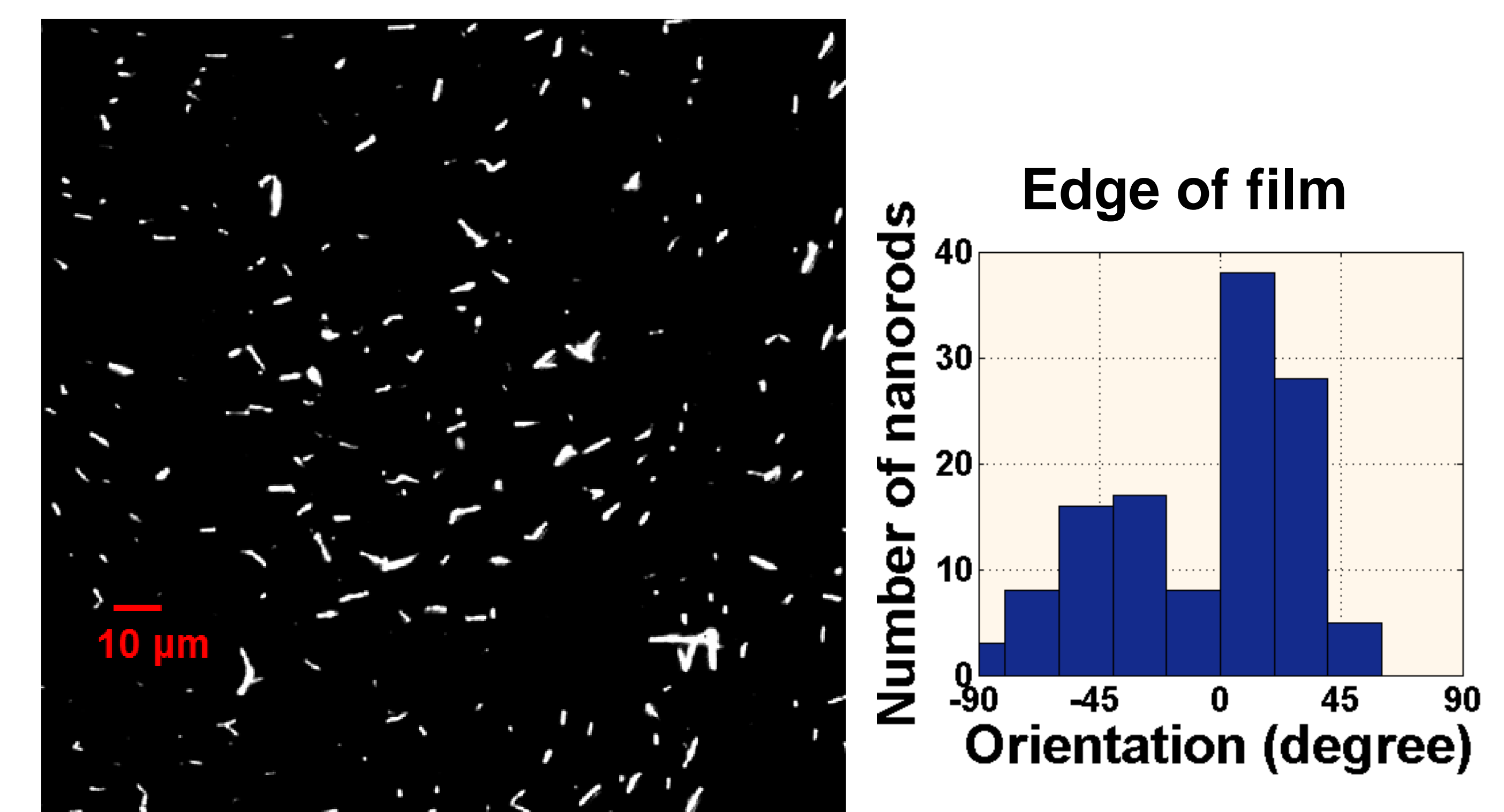
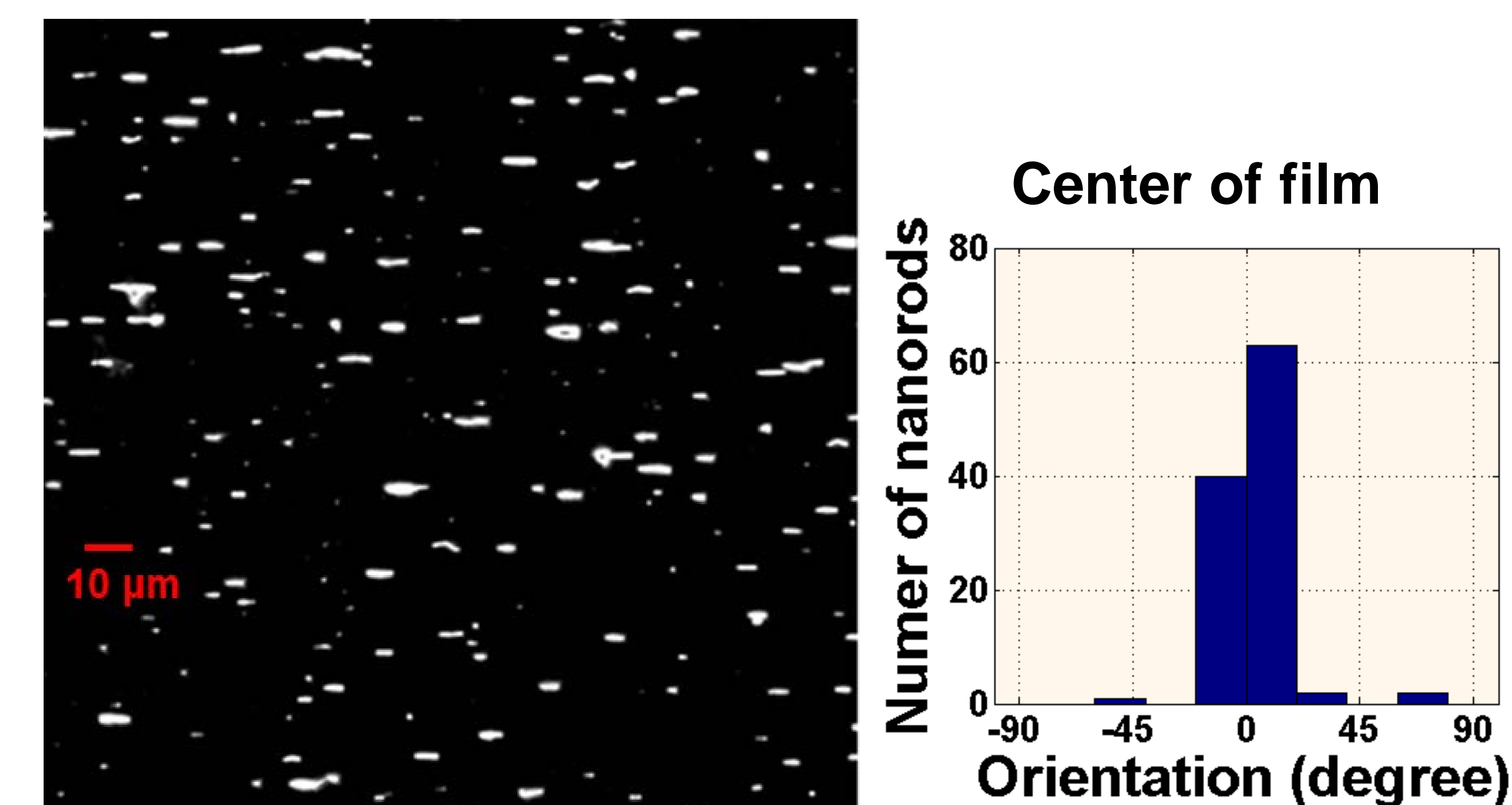
Distribution function F and probability to orient nanorods P at time t .



Film formation

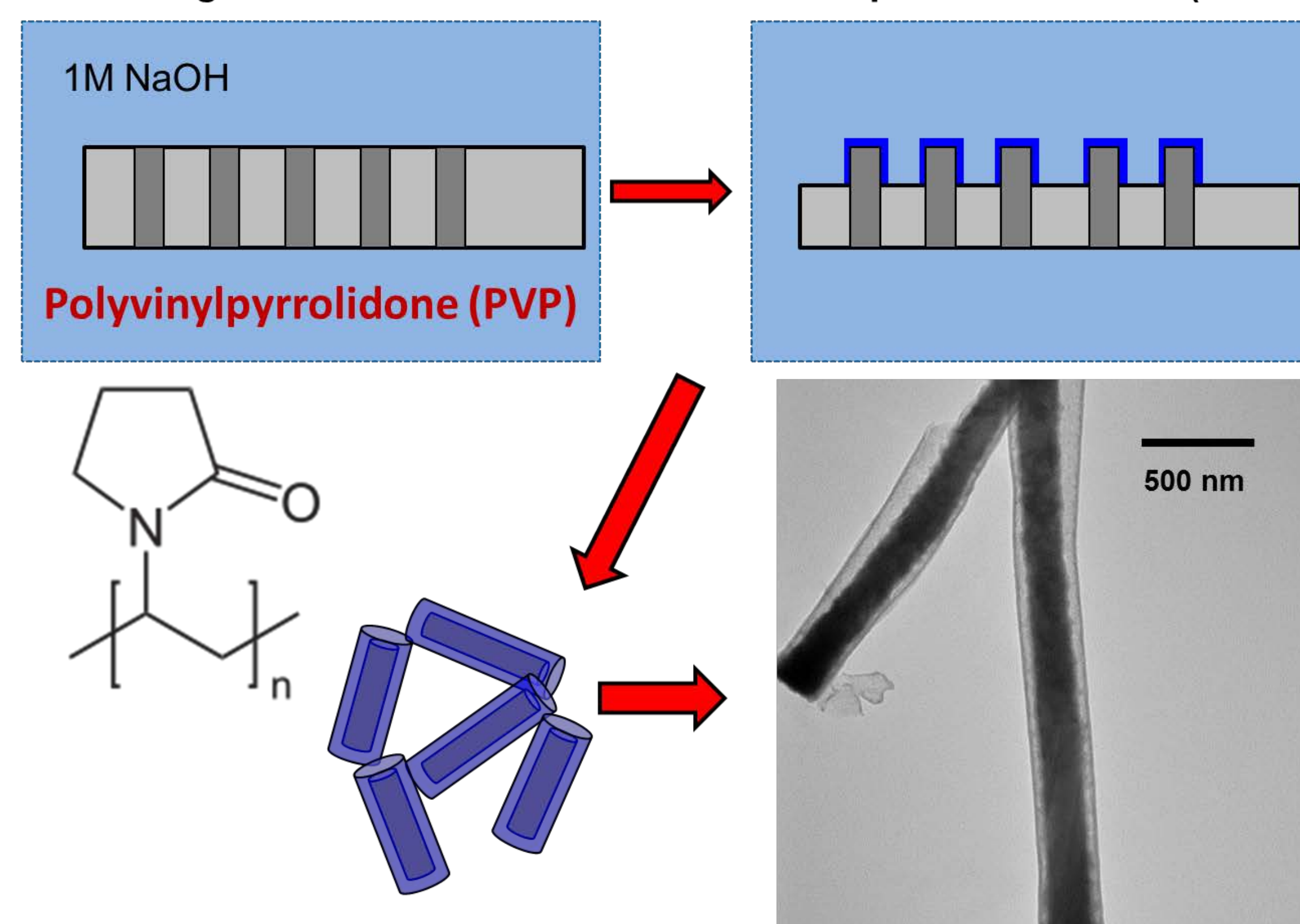


Orientation distribution

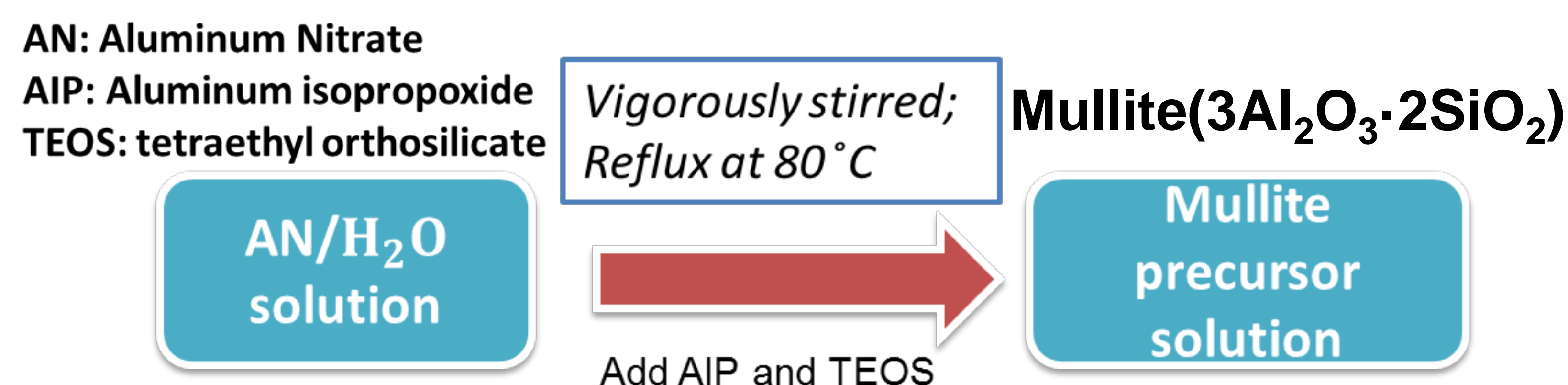


Surface modification of nanorods

wet etching on alumina membrane with rods in presence of PVP (3500 Da)



Film formation



Future work

Analyze the nanorod distribution function and compare with the theory. Test the property of composite material with ordered nanorods.

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