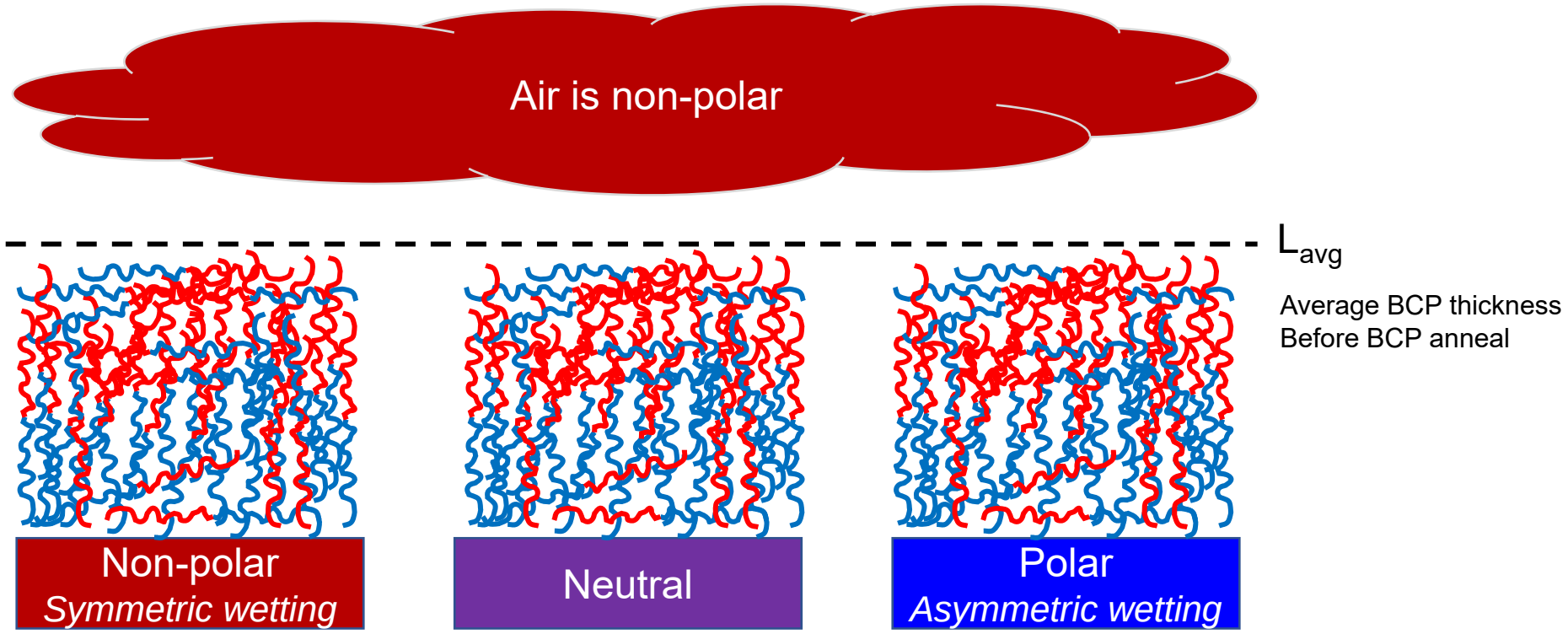
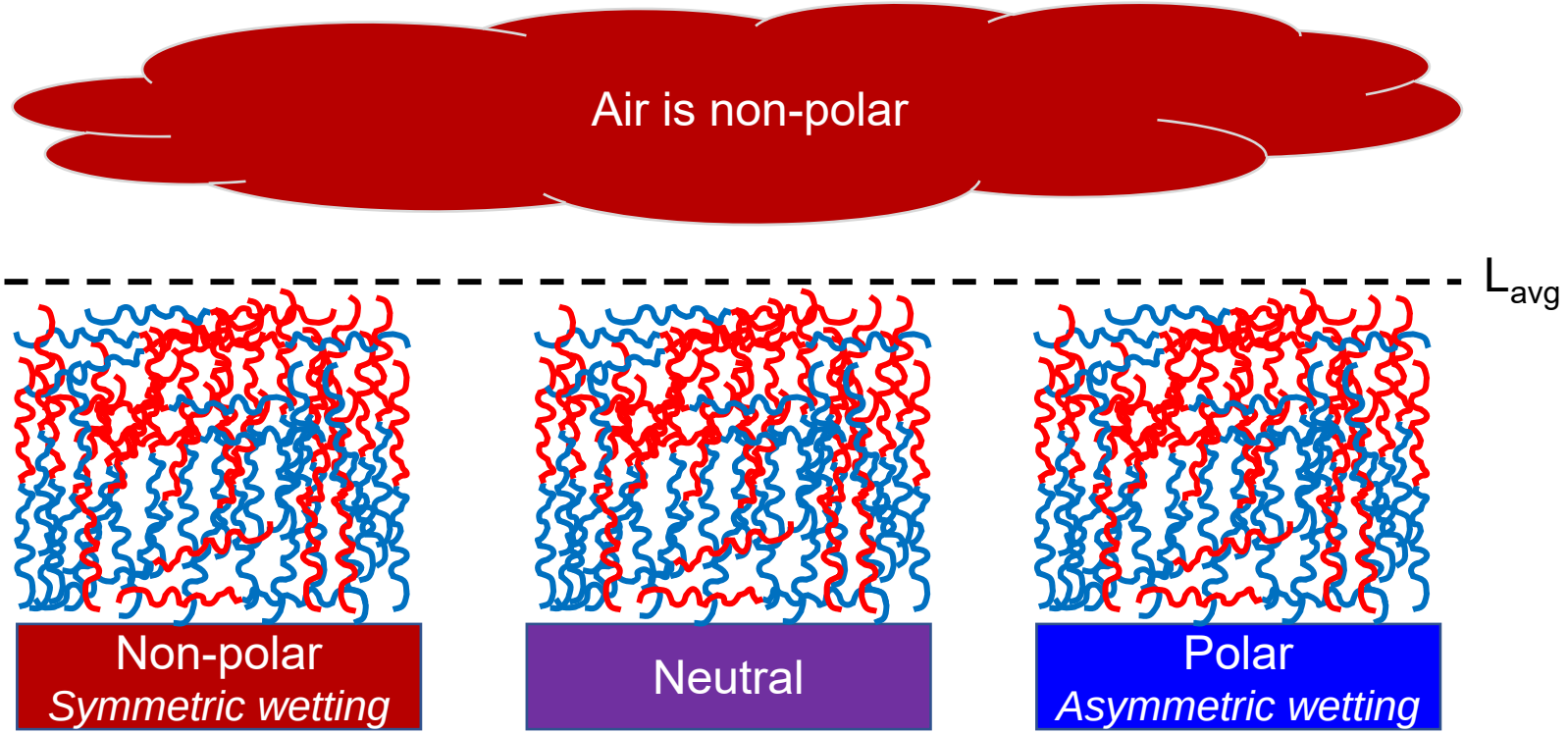
Islands and Holes Test of Silicon-containing Block Copolymers

First, identify whether the bottom surface is symmetric, asymmetric wetting, or neutral



After annealing, BCP will start to form islands or holes based on quantized film thickness and conservation of mass



$1L_o$ Islands
$nL_o < L_{avg} < (n+0.5)L_o$

$0.5L_o$ Islands
$nL_o < L_{avg} < (n+0.25)L_o$
Or, $(n-0.5)L_o < L_{avg} < (n-0.25)L_o$

$1L_o$ Holes
$nL_o < L_{avg} < (n+0.5)L_o$

$1L_o$ Holes
$(n-0.5)L_o < L_{avg} < nL_o$

$0.5L_o$ Holes
$(n+0.25)L_o < L_{avg} < (n+0.5)L_o$
Or, $(n-0.25)L_o < L_{avg} < nL_o$

$1L_o$ Islands
$(n-0.5)L_o < L_{avg} < nL_o$

where n is an integer

An Example

- A non-polar substrate for the BCP would mean that there will be symmetric wetting whereby both the air and the substrate will be non-polar
- This means that the BCP has to be oriented such that the red block will face the air surface and also the bottom surface
- This results in quantized BCP film thicknesses at nL_o: the BCP can only form film thickness at $1L_o$ or $2\ L_o$ or $3\ L_o$ etc
- If initial film thickness $L_{avg} = 1.65\ L_o$, the BCP can either form $1L_o$ or $2L_o$. Since $1.65\ L_o$ is greater than $1.5\ L_o$, by conservation of mass, the BCP will have to form more $2L_o$ than $1L_o$. This results in $1L_o$ holes.