ESRF	**Experiment title:** Exploring the origin of extraordinary mechanical properties of novel bottlebrush copolymers for biomedical applications	**Experiment number**: SC-4636
Beamline: BM26B	**Date of experiment**: BM26B 29/09/2017 - 02/10/2017	**Date of report**:
Shifts: 9	**Local contact(s)**:	*Received at ESRF:*

Names and affiliations of applicants (* indicates experimentalists):

CLAIR Charles Institut de Science des Materiaux IS2M

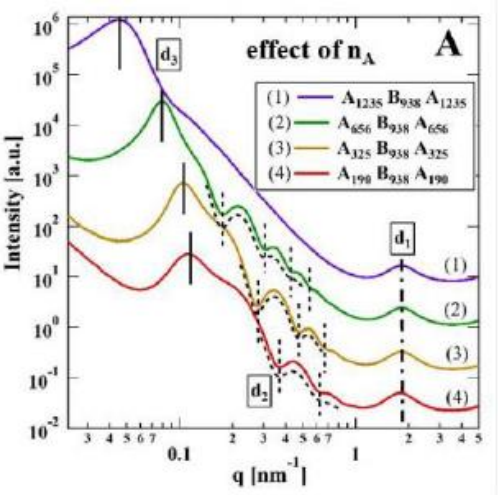
IVANOV Dimitri Moscow State University Laboratory of Soft Matter

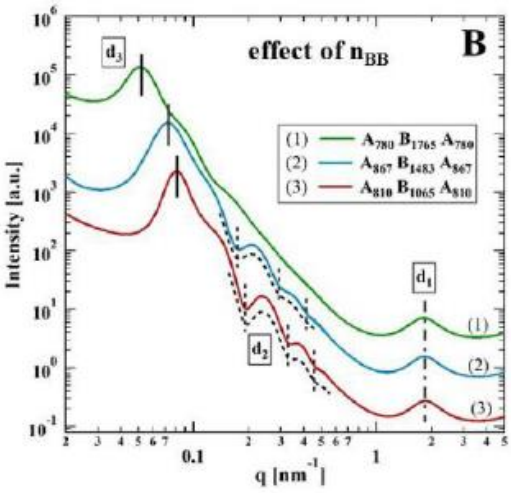
Report:

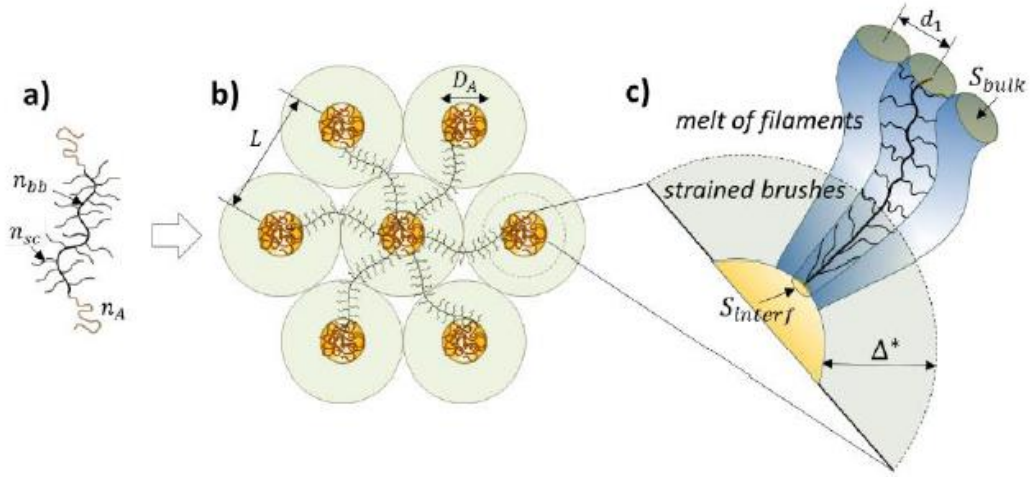
Data from experiment **SC-4505** obtained on ID02 and ID13 with data from experiment SC-4636 obtained on BM26 resulted in the following publication:

Clair, C., Lallam, A., Rosenthal, M., Sztucki, M., Vatankhah-Varnosfaderani, M., Keith, A. N., … Ivanov, D. A. (2019). Strained Bottlebrushes in Super-Soft Physical Networks. *ACS Macro Letters*, (April), 530–534. https://doi.org/10.1021/acsmacrolett.9b00106

ABA triblock copolymers composed of a poly(dimethylsiloxane) (PDMS) bottlebrush central block and linear poly(methyl methacrylate) (PMMA) terminal blocks self-assemble into a physical network of PDMS bottlebrush strands connected by PMMA spherical domains. A combination of Small- and Ultra-Small-Angle X-ray scattering techniques was used to concurrently examine dimensions of PMMA spherical domains and PDMS bottlebrush strands both in the bulk and at the PMMA-PDMS interface. In agreement with scaling model predictions, the degrees of polymerization of the bottlebrush backbone and PMMA block correlate with the measured PMMA domain size and area per molecule at the PMMA-PDMS interface
In the bulk, bottlebrush strands are extended due to steric repulsion between the side chains and unfavorable interactions between the different blocks. At the PMMA-PDMS interface with large curvature, packing constraints could require additional bottlebrush backbone extension and alignment of side chains along the backbone in the direction perpendicular to the interface.


effect of n_A
A
d_3
d_1
d_2
(1) A_{1235} B_{938} A_{1235}
(2) A_{656} B_{938} A_{656}
(3) A_{325} B_{938} A_{325}
(4) A_{190} B_{938} A_{190}
Intensity [a.u.]
q [nm^{-1}]


effect of n_{BB}
B
d_3
d_1
d_2
(1) A_{780} B_{1765} A_{780}
(2) A_{867} B_{1483} A_{867}
(3) A_{810} B_{1065} A_{810}
Intensity [a.u.]
q [nm^{-1}]


a)
b)
c)
n_{bb}
n_{sc}
n_A
L
D_A
d_1
S_{bulk}
melt of filaments
strained brushes
S_{Interf}
Δ^*