Paola Nicolella (ESR 10)

“Structure and diffusion in DDNs at the nano- to micro- scale”

Marie Sklodowska Curie ITN-DoDyNet
Double dynamics for design of new responsive polymer networks and gels

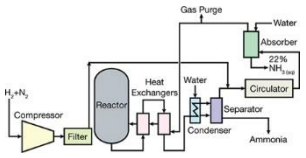
Mid-term check

DTU Meeting – May 2019

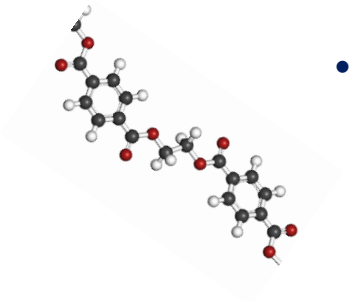
Prof. Dr. Sebastian Seiffert

Institute of Physical Chemistry
Johannes Gutenberg
University Mainz
Germany

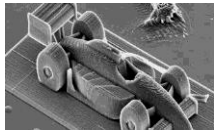
Education



- 2015, **Bachelor Degree in Chemical Engineering**
  Università degli Studi di Napoli Federico II – Italy
  - Chemical plants, Chemical reaction engineering, Industrial chemistry



- 2018, **Master of Science in Chemical Engineering (Molecules & Materials Engineering)**
  University of Twente – The Netherlands
  - Organic/Inorganic Materials Science, Elastomers Science & Engineering
  - Laboratory experience



- 2018, **Master of Science in Nanotechnology**
  University of Twente – The Netherlands
  - Characterization and Fabrication of Nanostructures, Cleanroom

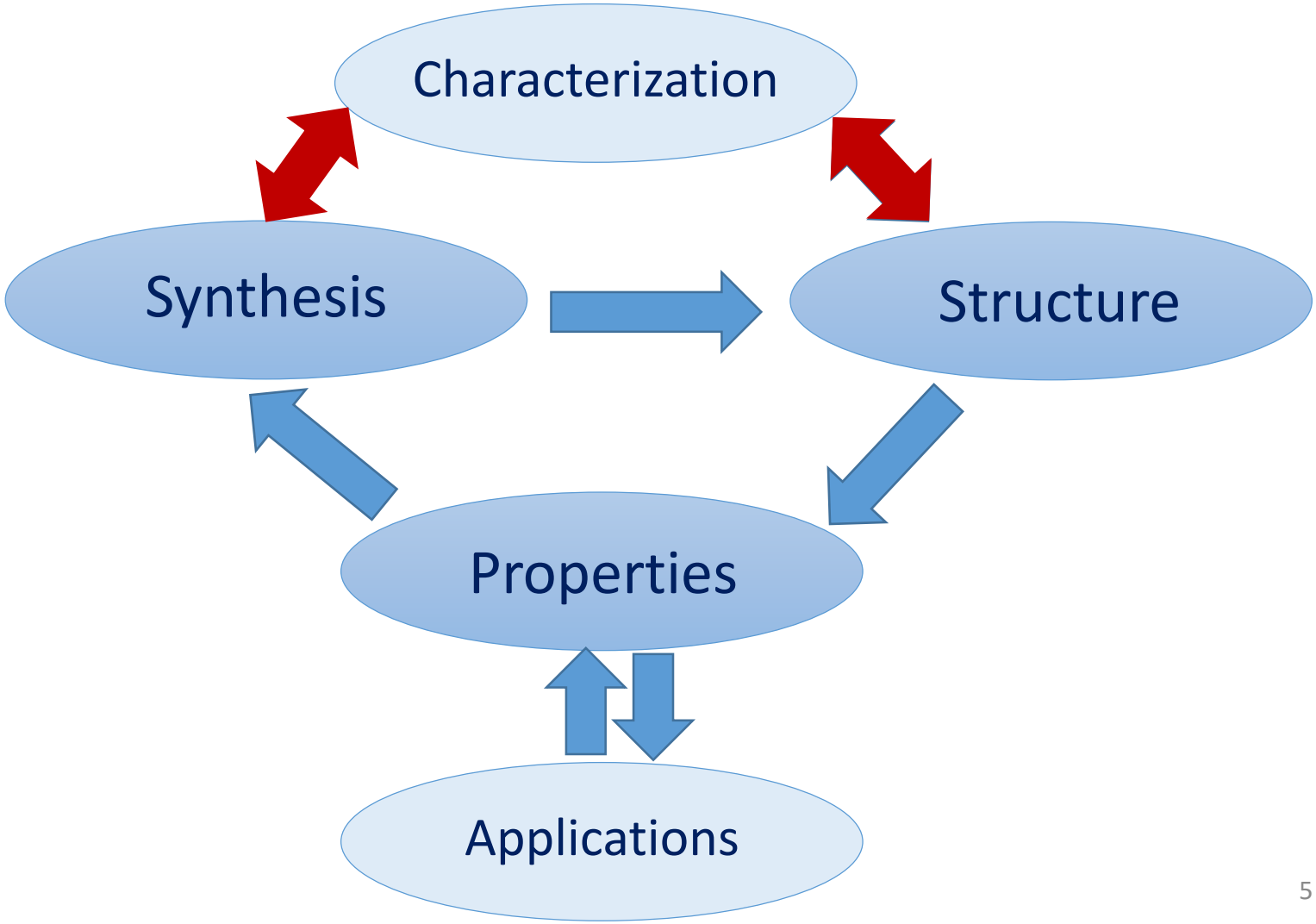
Experience

- **Internship – Apollo Tyres R&D**
  Enschede – The Netherlands
  - Broadening of the tan δ curve with new polymers enhancing the wet grip without affecting rolling resistance (2 patents filed)

- **Master Thesis – University of Twente**
  Enschede – The Netherlands
  - Adsorption of macromolecules on designer substrates by Atomic Force Microscopy based Single Molecule Force Spectroscopy: the role of the surrounding medium
    (Sebetia Ter Award 2019)

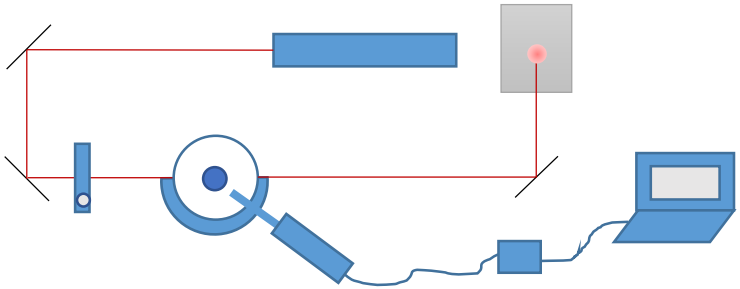
Sebetia Ter 2019 - Award

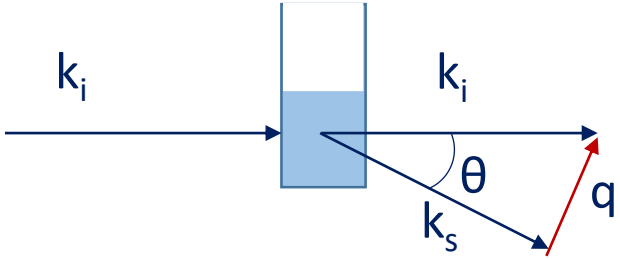
Objective


Characterization
Synthesis
Structure
Properties
Applications

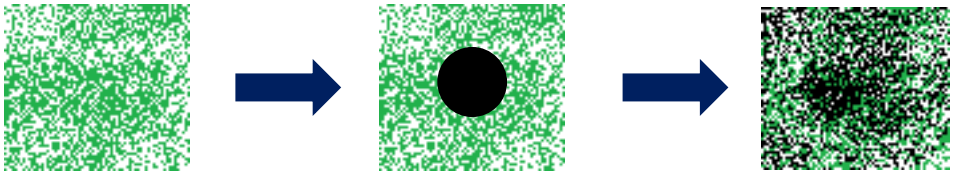
Objective

- Characterization of the structure of double dynamic networks with light scattering

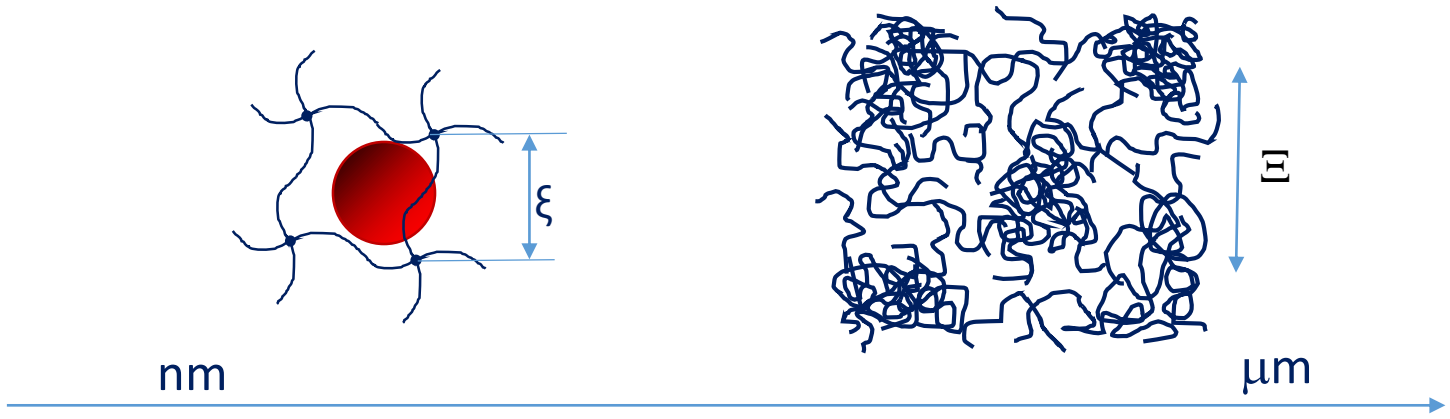




- Investigation of the diffusion in double dynamic networks with probe diffusion techniques



Methods



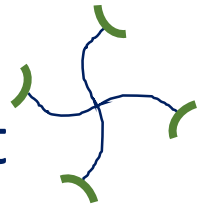
Probe diffusion

Light Scattering

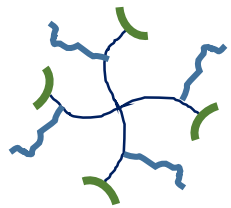
From the nano- to micro- scale

Results

- Functionalization of 4-arm Poly-ethylene-glycol with Terpyridine and its characterization with light scattering



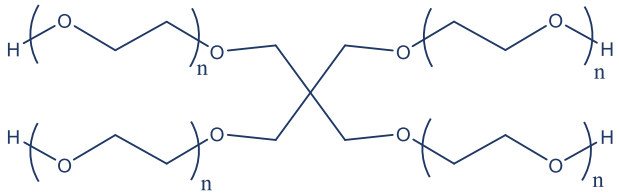
- Synthesis of 4-arm Poly-ethylene-glycol with Terpyridine and additional functional group



- Tutorial review on scattering and probe diffusion techniques

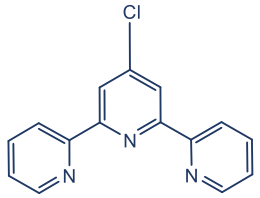
Results

Synthesis



4-arm Poly ethylene glycol (PEG)
10 000 g/mol

+

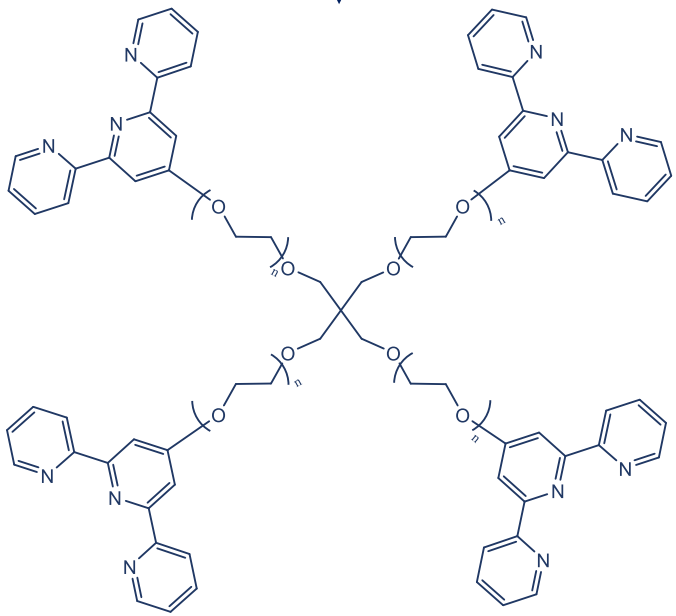


Chloro terpyridine

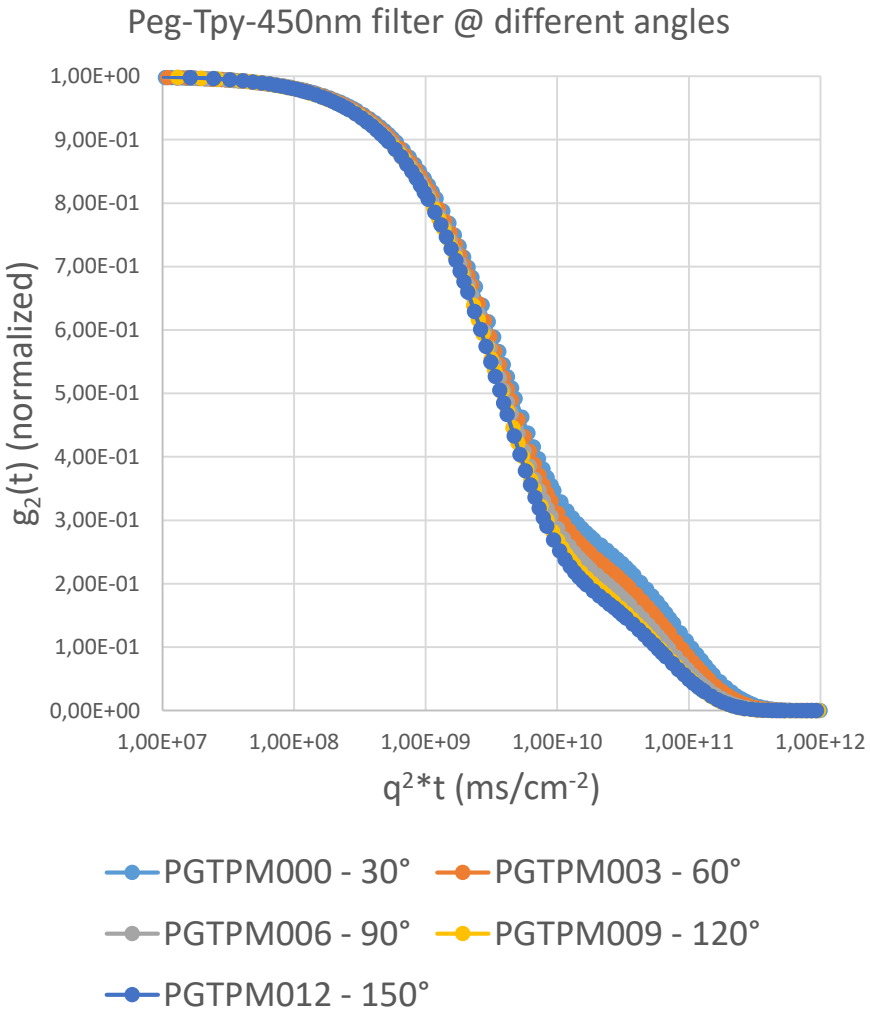
DMSO (dry)

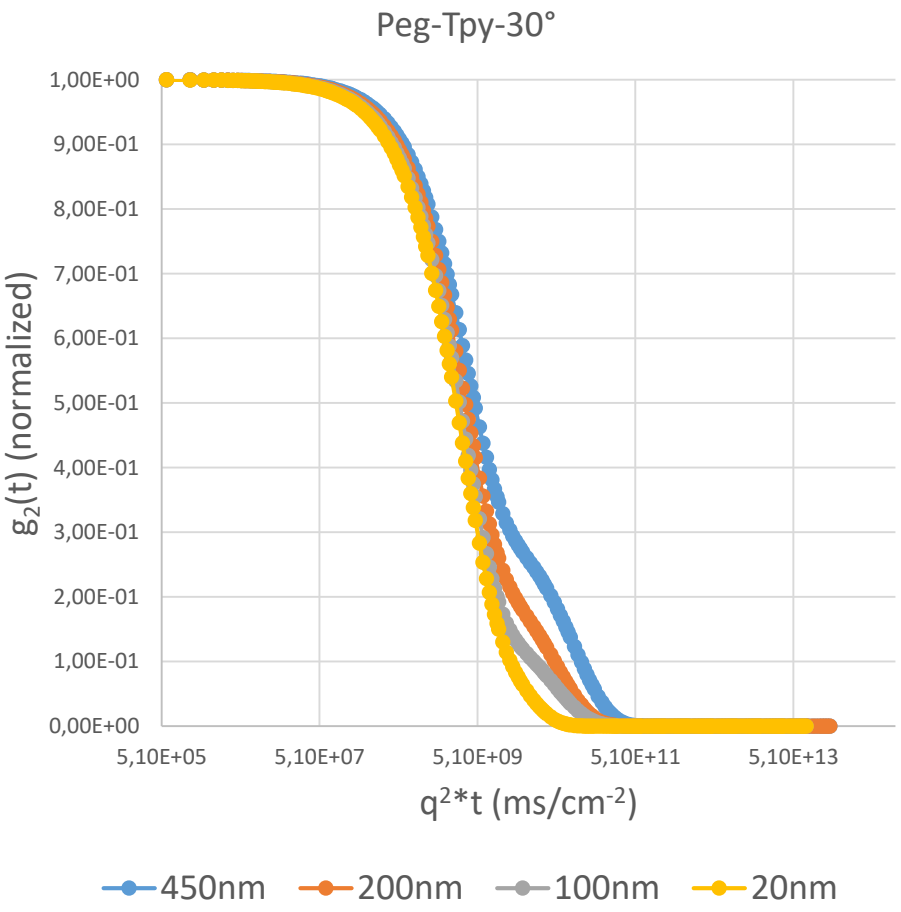
KOH

Kryptand 2.2.2.

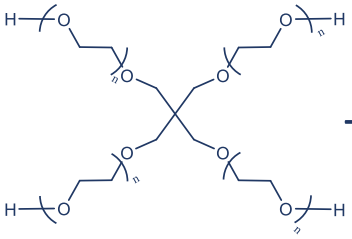


Results

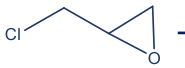

Peg-Tpy-450nm filter @ different angles
1,00E+00
9,00E-01
8,00E-01
7,00E-01
6,00E-01
5,00E-01
4,00E-01
3,00E-01
2,00E-01
1,00E-01
0,00E+00
g2(t) (normalized)
1,00E+07
1,00E+08
1,00E+09
1,00E+10
1,00E+11
1,00E+12
q2*t (ms/cm-2)
PGTPM000 - 30°
PGTPM003 - 60°
PGTPM006 - 90°
PGTPM009 - 120°
PGTPM012 - 150°


Peg-Tpy-30°
1,00E+00
9,00E-01
8,00E-01
7,00E-01
6,00E-01
5,00E-01
4,00E-01
3,00E-01
2,00E-01
1,00E-01
0,00E+00
g2(t) (normalized)
5,10E+05
5,10E+07
5,10E+09
5,10E+11
5,10E+13
q2*t (ms/cm-2)
450nm
200nm
100nm
20nm

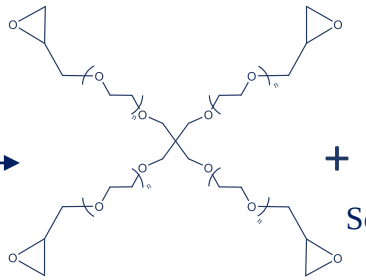
Synthesis of double dynamic network



Peg-OH



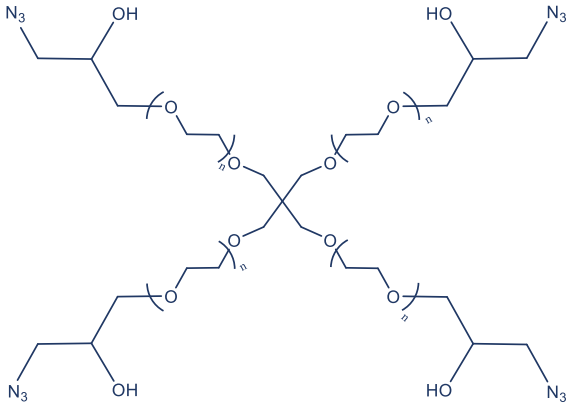
Epichlorohydrin



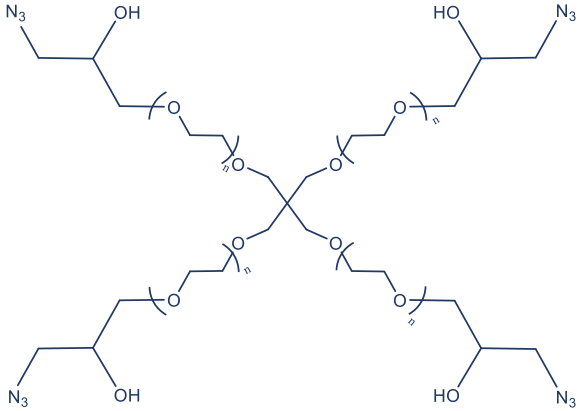
Peg-epoxide

NaN_3

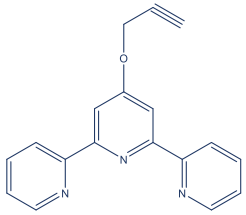
Sodium azide



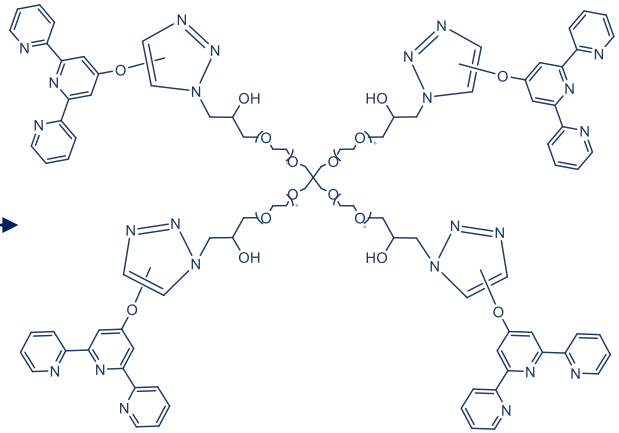
Peg-hydroxy azide



Peg-hydroxy azide



Propargyl terpyridine



Peg-hydroxy terpyridine

To do:

- Synthesis and attachment of PNIPAM

- Characterization of the sample
- Characterization of other samples of the consortium

Training

In addition to all DoDyNet meetings:

- Physical chemistry of polymers 1
- Physical chemistry of polymers 2
- Organic chemistry practical courses
- Supervision of students
- Conferences at the University
- German for science
- French basic

Secondments

- Influence of synthesis protocol on the structure at UCL

UCLouvain

- Structure and diffusion in coating applications at Allnex

allnex
The Coating Resins Company

Expectations

- Numerous international and interdisciplinary collaborations
- Publications in journals with high impact factor
- Participation to international conferences

https://slidemodel.com/templates/editable-world-map-connections-powerpoint/

Future plans

- Research in polymer field
- Sustainability

https://www.vice.com/en_us/article/d7ax5y/these-plastic-eating-machines-will-filter-our-junk-from-the-ocean

https://ibanplastic.com/clean-the-world/