Il contributo dei Giovani Chimici in Campania 2023

Società Chimica Industriale (SCI)

Sezione Campania

Chemical and thermomechanical recycling of post-used petroleum and bio-based plastics

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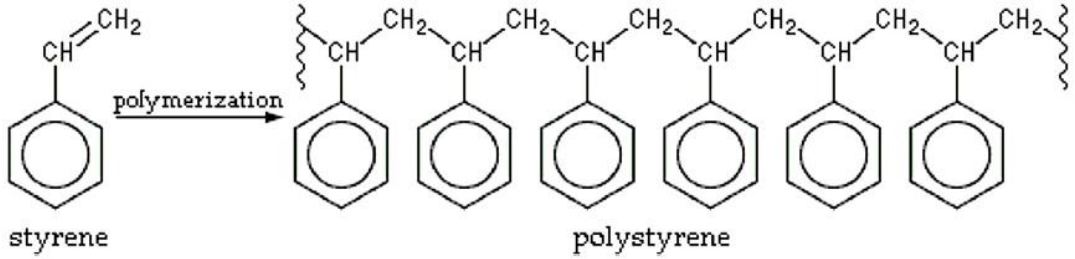
Expanded polystyrene (EPS)

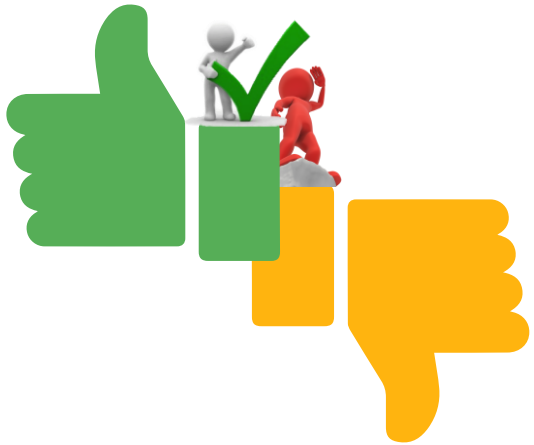


The total global market value of EPS

13 871.7 million U.S. dollar 2016

18 797.6 million U.S. dollars 2021

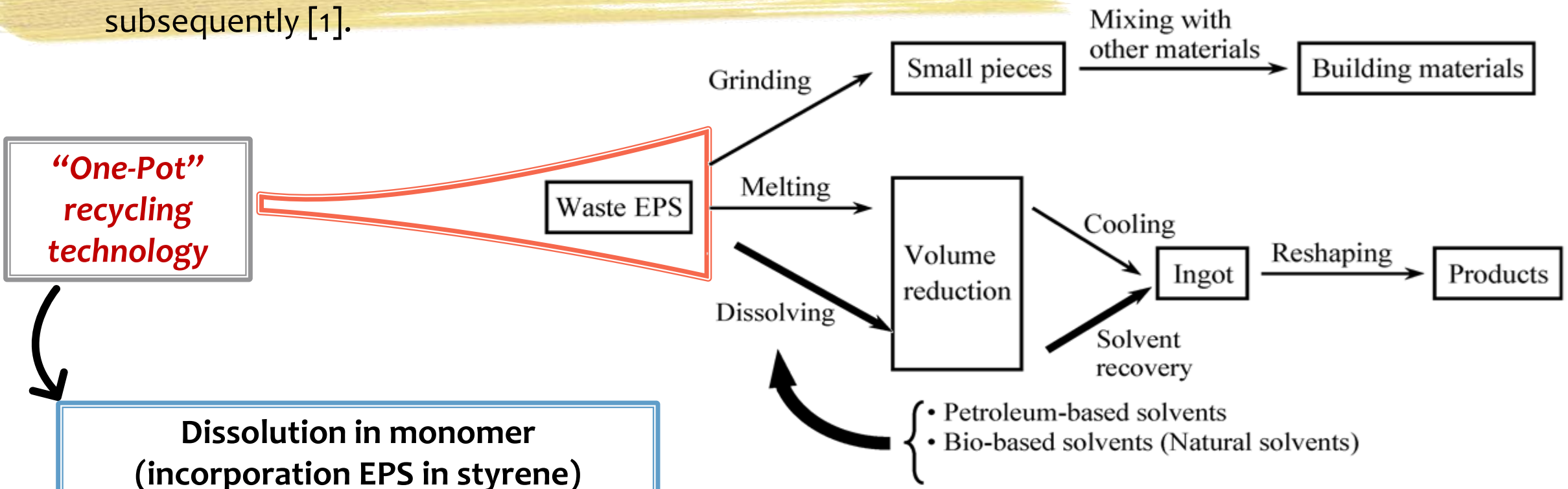
- Low thermal conductivity (excellent insulation),flexible mechanical properties, good energy absorption (packaging).
- Low cost per volume/cost-effective, versatility in shapes, sizes and combability with a wide variety of materials.



- Highly voluminous products taking up much space during transporting, **major post-consumer waste product because of low poor rate of recycling.**

EPS recycling technologies

– For the recycling of EPS, melting or solvent treatment is required to reduce the volume and to be reshaped subsequently [1].

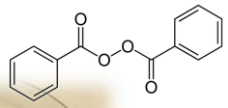


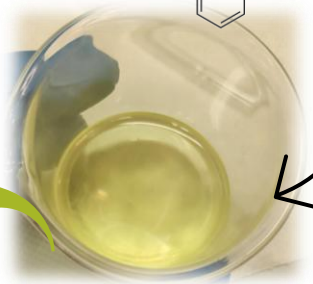
[1] G. D. Mumbach, A. Bolzan , R. A. F. Machado, A closed-loop process design for recycling expanded polystyrene waste by dissolution and polymerization, Polymer, 209 122940, (2020)

Experimental set-up

EPS waste

Benzoyl peroxide (BPO)

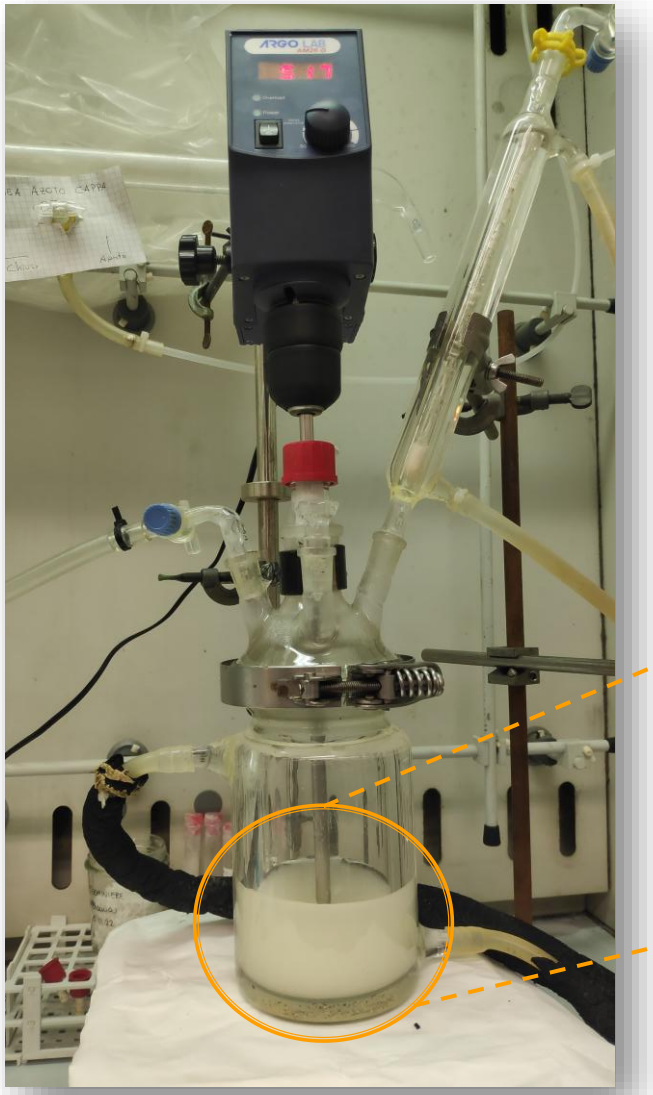




Styrene

Dissolution PS/EPS in styrene (*incorporation*)

Dispersing Polyvinyl alcohol (PVA) + H_2O



Suspension polymerization reaction

Beads of rPS new product

Preliminary results

Samples	M_n (Da)	M_w (Da)	M_z (Da)	$T_{onset,\ 5\%WL}$ (°C)	$T_{inflection}$ (°C)	T_{peak} (°C)	T_g (°C)	Code product
Synthesis of polystyrene by monomer	**76.1**	**179.8**	347.3	348.4	410.0	437.8	106.0	PS
AIRPOL	**125.5**	**206.6**	341.8	374.2	410.8	443.2	103.8	EPS
40% wt. of EPS in Styrene + incremental polym.	**131.9**	**243.1**	416.8	361.9	413.9	442.6	99.6	rPS40
52% wt. of EPS in Styrene + incremental polym.	**143.2**	**238.1**	387.0	298.4	411.2	444.3	100.4	rPS52

M_n= Number average molecular weight

M_w = Weight average molecular weight

M_z= Z-weight average molecular weight

IV = intrinsic viscosity