Design from Recycling for post-consumer WEEE plastics

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6th International Conference on Sustainable Solid Waste Management
Naxos, June 2018
CPMT group & team recycling

3D Printing
- Extrusion based 3D Printing
- 3D Printing of composites
- Printhead development
- Development of new materials for 3D Printing
- 3D Printing build strategies
- Fablab UGent

Advanced Polymer Processing
- Injection Mould Engineering
- Conductive polymers
- Hybrid Moulds
- Process simulation

Recycling and Sustainable Use
- Mechanical recycling
- Mixed plastic waste
- Multilayer packaging
- WEEE recycling
- Compounding
- Microfibrillar composites
- Design for Recycling
- Design from Recycling
- Degradation effects
Our mission is to contribute to the circular economy by demonstrating the sustainable potential of plastics. This is achieved by transferring fundamental materials science to improved industrial processing of recycled plastics.
Presentation outline

- Framework: (WEEE) plastics in the EU
- Design from Recycling
- Tools for Design from Recycling
- Outlook
Solid plastic waste in EU

In ten years, plastic waste recycling has increased by almost 80%

From 2006 to 2016 the volumes of plastic waste collected for recycling increased by 79%, energy recovery increased by 61% and landfill decreased by 43%.

Source: Plastics The Facts 2017, PlasticsEurope
EU Strategy for Plastics in a circular economy

- Released January 18
- Includes overview of planned EU measures to implement Strategy

Goals:
- 2025: recycle 55% of plastics packaging
- 2030: all plastics packaging recyclable
- 2030: over 50% of ALL plastics are recycled
Plastics in WEEE

- Dominated by ABS, HIPS and PC
- Challenges for effective recycling:
  - *Flame retardants*
  - *Stable supply*
  - A sufficient ‘feel‘ for the properties
  - Specific design guidelines

Figure 1: Typical composition of the plastics fraction within WEEE (Achilias and Antonakou 2015)
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Design for Recycling

‘As a first step, and under the framework of the Ecodesign directive, the Commission has developed and will propose shortly to Member States mandatory product design and marking requirements to make it easier and safer to dismantle, reuse and recycle electronic displays.

‘The Commission is also proposing to encourage better product design by differentiating the financial contribution paid by producers under extended producer responsibility schemes on the basis of the end-of-life costs of their products. This should create a direct economic incentive to design products that can be more easily recycled or reused.’

‘The designed-for-recycling method incorporates recycling and recyclability criteria into the design phase of products, with the aim of obtaining recycled and/or recyclable products.

Design for Recycling relates to:

– design for disassembly
– eco-design (EU Ecodesign directive)

= designing a product to make it easier to recycle into the individual composing materials at its end-of life.

Julio Rodrigo and Francesc Castells, Rovira i Virgili University
Design for Recycling

making it easier to recycle the individual materials making up the product at its end-of life

Source: EU Parliament, 2015, Circular economy: the importance of re-using products and materials
Design from Recycling

Developing new products, based on available recycled materials, at start-of life.

Material-driven design approach

1. Knowing the possibilities and properties of the available r-polymers
2. Matchmaking between products and available r-polymers
3. ‘tweaking’ r-polymers if you have to (remain cost-effective)
4. Adapted product design for r-polymers
   • This includes mould design

Making it easier to recycle the individual materials making up the product at its end-of life.
Design from Recycling

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*Material-driven design approach*

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*challenges*

- Engineer-speak vs designer-speak
- Recycling the recycled
  - *Retained functionality of additives*
- Industrial inertia
  - *Prices of virgin feedstock*

*Design from Recycling requires a close symbiosis between designers and engineers*
Design from Recycling
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Design strategy – new product

- A step-by-step process for the development of a good product
- Consider the recycled material as ‘just another material’ with its given properties
Design strategy – recycled content drop-in

• All steps have already been taken. Moulding tool is in place and must be used with minimum adjustment
• Aim to bring recycled materials as much as possible to the same properties as the virgin material, both in terms of mechanical properties and processing.
• --> blending, use of additives, adapted processing conditions
the dEEEterminator

- A tactile tool for the hands-on evaluation of material properties
- Supplement to TDS
- Allows to bring out aspects, specific to EEE products like gloss, snaps, living hinge, screw boss, surface thinning…
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Outlook

- Application of Design from Recycling strategy and tools to effective products in large-scale demonstrator project PolyCE
- Expected to market from 2019 onwards
THANK YOU FOR YOUR ATTENTION

PolyCE
Post.Consumer High-Tech Recycled Polymers for a Circular Economy

www.polyce.eu

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This project has received funding from the European Union’s Horizon 2020 research and innovation program under grant agreement N° 730308