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PLA Extrusion-Coated PLA Fabrics for the Application as Ecologically and Economically Sustainable Advertising Banners

Introduction

Advertising banners:

- provide excellent opportunities for advertising products and services
- are produced by polyvinyl chloride (PVC) coating of polyester (PET) or polyolefin fabrics, and
- have to be landfilled or incinerated after reaching their end of product life

Fig. 1: Advertisement banners for short-time use.

Motivation and Approach

Landfilling and incineration are costly, harmful to the environment and cause customers' dissatisfaction.

The developed single-origin PLA-based banners are

- bio-based,
- bio-degradable and can be
- recycled

Materials and Methods

- PLA compounds (Ingeo 2003D and 4060D from NatureWorks LLC./USA, Ecovio from BASF SE/Germany),
- various additives (e.g. $CaCO_3$, TiO_2), and
- plasticizers (e.g. Soft-N-Safe (SNS) from DuPont Corp./USA, citrate esters from Jungbunzlauer Ladenburg GmbH/Germany, Capa PL1000 or 2043 from Perstorp Holding AB/Sweden)

have been tested to realize flexible banners with good printability and adhesion properties.

Various textile fabrics were used for extrusion-coating tests with selected PLA-formulations to give a PLA-coated PLA fabric.

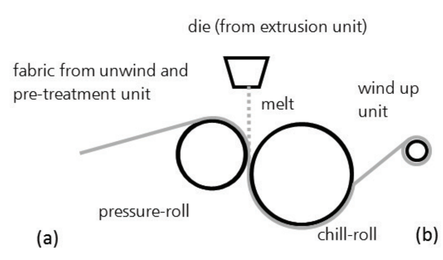

Fig. 2: Extrusion coating: (a) principle, (b) experimental set-up based on a PTW16 extruder (Thermo Electron GmbH/Germany) and a BSD100 chill-roll device (Dr. Collin GmbH/Germany) for coating in amounts from 0.5 to 2 kg.

Results

The stiffness of PLA depends on the type of plasticizer and content used for compound formulation. This effect is demonstrated by gradually lowered glass transition temperature Tg in Fig. 3.

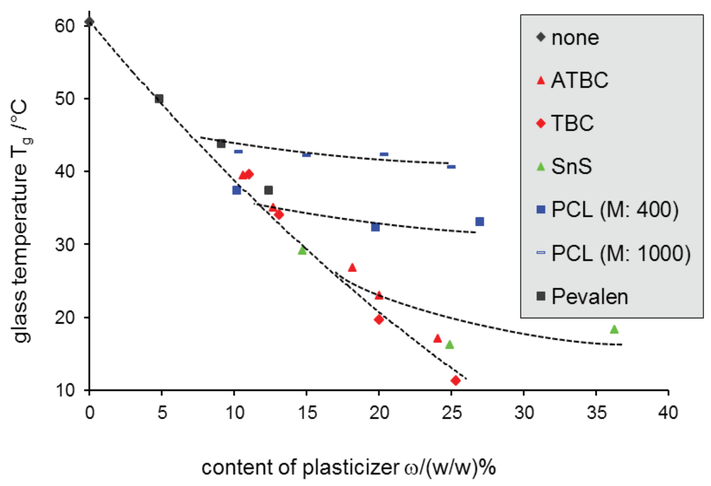

Fig. 3. Influence of plasticizers on the of glass transition of PLA (Ingeo 2003D) – determined by DSC (*= saturation levels).

The processing temperature was lowered for extrusion-coating without melting the fabric:

- The developed formulations can be processed from 100 °C to 140 °C, i.e. below the melting point of PLA fabrics with Tm: 174 °C.
- Printability was tested on a PLA extrusion-coated non-woven, using additives (TiO_2, $CaCO_3$) to obtain opacity.
- A laser-printed sample is shown in Fig. 1.

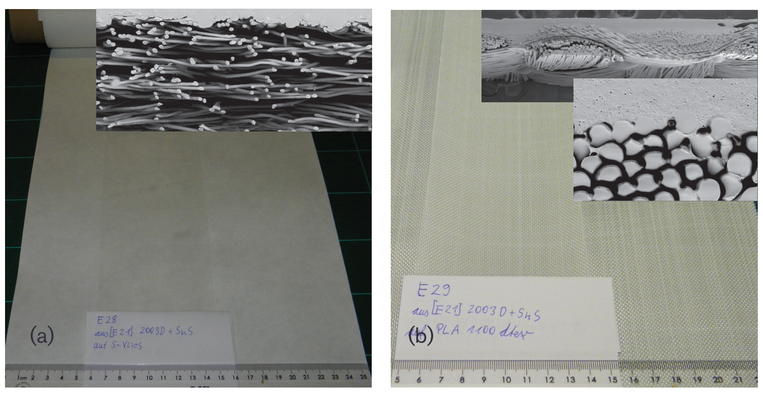

Fig. 4. Results: Samples of PLA coated fabrics, including SEM images of cross sections: Ingeo 2003D with 20 % (25 phr) SNS on: (a) nonwoven (Felix Schöller Group/Germany), (b) PLA fabric Diolen 150BT multifilament, 1100 dtex, f105, L9/9 (PHP Fibers GmbH/Germany).

Conclusions

PLA compounds have systematically been developed for extrusion coating of PLA fabrics.

These bio-based and bio-degradable single-origin PLA based materials show sufficient flexibility, printability for the application as advertisement banners.

Printed Material Samples

Printed PLA-coated nonwoven (Ecovio, 20 % SNS (25 phr) and 0.9% (1 phr) titanium dioxide.

References

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[2] A. Giessmann, Coating substrates and textiles: a practical guide to coating and laminating technologies; Berlin: Springer (2012).

Acknowledgement

The research project MF140041 was promoted in the framework of the program "INNO-KOM-Ost" of the Federal Ministry of Economics and Energy based on a resolution of the German Bundestag. We would like to thank for the support granted.

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Supported by:
Federal Ministry for Economic Affairs and Energy
on the basis of a decision by the German Bundestag

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