

## Characterization of composite flexographic printing plate carriers and their influence on cardboard packaging print quality

*Impact Case Study*

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### *Abstract*

Flexography is a printing technique which is, like all the other printing techniques, dependant on the variety of parameters defining the process and the quality of the printed product. Apart from that, the development of technology is continuously contributing to the growth in quality and the productivity of flexography. Following the development of the technology is a need for characterization of the new or modified components of the process, especially if they are not thoroughly investigated in their previous iterations.



One of the variable parameters of flexography experiencing rapid development are the materials for mounting the plates on the sleeves, and the sleeves themselves. The sleeve technology currently being considered as the "cutting edge" bares the name Twinlock® sleeves.

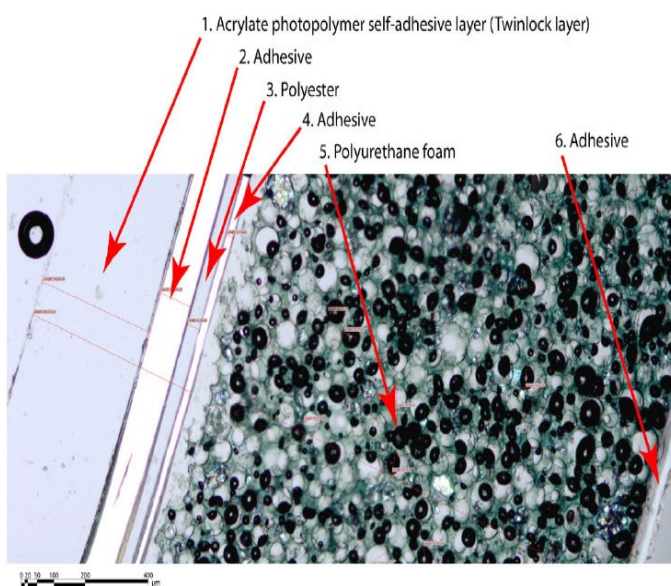
Changes in most of the flexographic printing parameters, as well as the print quality, have been monitored in the scientific research conducted so far. However, the sleeve quality parameters have not been

previously monitored, and neither were their changes brought into correlation with the quality of the printed product. The above facts point to the need for characterization of sleeves and monitoring their changes and the impact of the changes on the quality of the printed product.

Based on previous observations, the main objective of the research is to find parameters which can be used in the non-destructive method for determination of the sleeve condition. The results are expected to be applicable in practice at the industrial level, during the process quality control through measurements by standard devices on standard control patches.

Sleeves can be characterized by a number of terms directly affecting their properties and the quality of the process and the end product. The most important ones are the compressible layer and its mechanical properties, and in the case of Twinlock® sleeves, the adhesive layer and its adhesive properties. The main cause of the changes in the mechanical properties of the compressible polyurethane layer lies

in the printing process, where the sleeves suffer the greatest stress and are exposed to the influence of various components from different sources. Mechanical changes relate to changes in compressibility, resilience, hardness, as well as the loss of energy through heat generation. The leading cause for the changes in adhesion properties, which are particularly significant in the case of the Twinlock® sleeve adhesive layer, lies in the mounting process of flexo printing forms, during which the composition of the adhesive layer may change.



All the above-mentioned changes can have a negative effect on the predictability and stability of the printing process. At the same time, the quality of the end product can be affected negatively or positively, depending on the parameter being observed. The impact on the stability of the printing process can be manifested through the occurrence of short-stops, permanent damage to printing forms, or changes in the temperature and viscosity of inks. On the other hand, product quality can undergo changes through tonal value increase, optical density, print uniformity, trapping, colour difference, slur, dot void, dot diameter and edge factor.



Characterization of changes of the previously mentioned mechanical, adhesion and print quality parameters was carried out through the research. Apart from that, the main causes were found for all of the changes. Bringing the results of the characterization of the changes of sleeve properties and print quality parameters into correlation enabled defining of the most reliable parameters and the trends and values of their changes, on the basis of which it is possible to establish the condition of the sleeves through non-destructive methods. In addition, the obtained results help in selecting adequate sleeves according to the type and level of exploitation, in relation to the printing requirements defined by the type of dominant printed motif.

### *Summary of impact beyond academia*

The methodology, results, and conclusions were shared with Tetra Pak, the leading cardboard food packaging producer in the world, thus helping them in pinpointing the main culprit behind some of the print quality parameters variations and increasing predictability of product quality. Apart from that, the results helped in estimating the right time for sending the sleeves for reparation or selecting the best possible sleeve (regarding level of its previous exploitation) for certain print runs, depending on the combination of motifs which are to be printed. The same results were shared with Tipoplastika, the leading flexible packaging printing company in the region, leading to similar results.

The results were also shared with some of the other leading companies in the field, resulting in invitation to participate in DFTA working group for air cylinders and sleeves established to revise standardisation recommendation and create troubleshooting guide.

### *Underpinning research, context and summary of methodology*

The scientific contribution of the research is reflected in defining the method for characterization of polyurethane compressible foams and adhesive polymeric materials in the field of graphic engineering, as well as defining the mechanisms of changes caused by exploitation and mutual influence of different parameters present in flexographic printing. In addition, the impact of sleeves and the level of their exploitation on print quality was defined by measuring a large number of print quality parameters belonging to different groups. In this way, the influence of sleeves as one of the constituent elements of the flexo printing, which has been recognized in the



literature, but has so far been almost completely unexplored, has been reliably characterized.

The application of the results in practice is reflected in the contribution to the companies engaged in flexographic printing and using compressible sleeves, as well as companies engaged in the development of new technologies in the field of plate-mounting materials for flexographic printing or their production. During the control process, printing companies can use the non-destructive method proposed and applied in the dissertation, which would increase the stability of the printing process and predictability of product quality or easily determine the condition of sleeves and for which jobs they are most suitable. Companies working on the development of new technologies or production of sleeves could use the method of characterization and conclusions about which properties are desirable, but are currently insufficiently good, to develop a simulation of the impact of exploitation on key sleeve properties and consequently on key print quality parameters. In this way, the development of new plate mounting technologies would be simplified, accelerated and reduced in price. In the field of sleeve production, the proposed method and conclusions could also be used during the final product quality control.

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### *Details of impact*

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Invitation to participate in DFTA working group for air cylinders and sleeves established to revise standardisation recommendation and create troubleshooting guide

Use of certain parts of methodology, results, and conclusions by Tetra Pak

"Champion of knowledge" award and recognition of work by Brainz TV





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