



Toward a Circular Economy for Labels

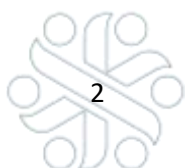
LABEL FILMIC RELEASE LINERS

*FILM BASED SILICONE RELEASE LINERS FROM LABELS
CAN & SHOULD BE RECYCLED*

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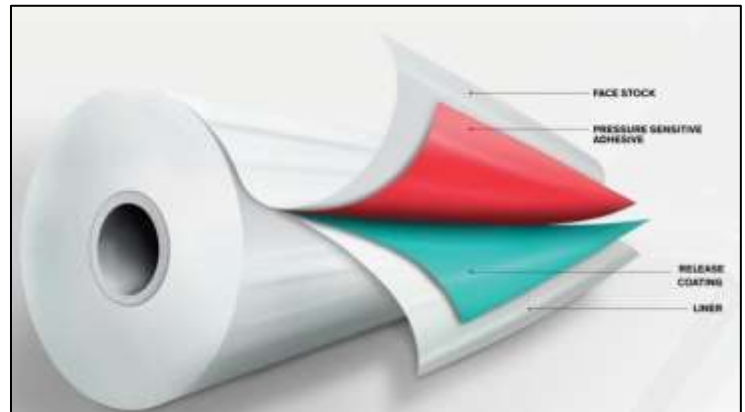
INTRODUCTION

CELAB: *Toward a Circular Economy for Labels* is publishing this white paper to provide basic technical information on release liner recycling on a “global” basis. CELAB’s Technical Workstream, under the leadership of Alex Knott, Senior Scientist at The Dow Chemical Company, conducted a technical review of release liner recycling to understand existing recycling technology. CELAB collected non-proprietary information on current processes by obtaining input from raw materials producers (films and silicone), liner producers, recycling companies (collection) and industry organizations to understand the impact of release liner on final recycled film products and their manufacturing processes.

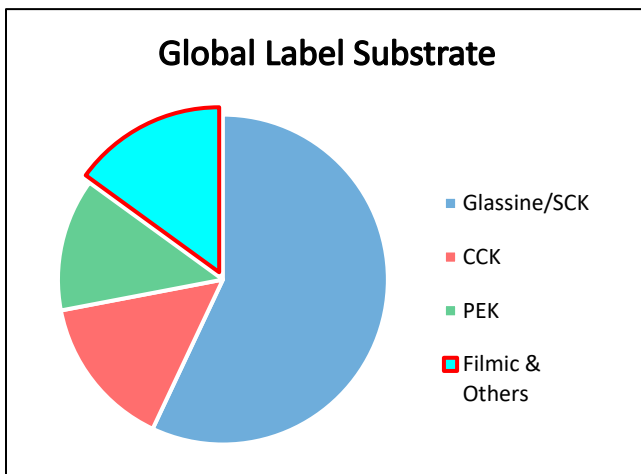
PART A – WHAT IS A FILM BASED SILICONE RELEASE LINER?

In their most typical format, self-adhesive labels are a combination of a self-adhesive label material laminated against a ‘silicone release liner’. They are produced by taking a ‘base’ substrate (in this case, film), onto which a silicone release coating is applied as a very thin layer, followed by a self-adhesive layer and finally a label ‘face’ material (paper or film). The ‘silicone release liner’ is the layer of ‘base’ substrate which is coated with silicone, and from which the label is peeled away during dispensing.

Self-adhesive labels are the most commonly used technology in the labelling industry, meeting a wider range of end-user requirements more effectively than any other labelling format. They need to cover a wide range of applications where the self-adhesive needs to adhere to many different surfaces such as glass, plastic, paper, textiles, wood and metals. Their adhesion might need to be temporary (removable) or permanent and meet all kinds of different adhesion challenges for labelling depending on the wide range of applications where they are used (deep-freeze, wet labelling, high temperatures, low surface energy and even underwater). The release liner performs a critical role in supporting the label during die-cutting, protecting its adhesive and providing a surface from which the self-adhesive label can be subsequently dispensed and applied. The silicone release coating itself is a very thin coating on the surface of the base paper (typically between 0.8 micrometers and 0.1 micrometers in thickness, or 0.0008 to 0.0001 of a millimeter).



WHAT KINDS OF SUBSTRATES ARE USED FOR FILM BASED SILICONE RELEASE LINERS?



While the majority of silicone release liners used in self-adhesive labels are based on using paper as a base substrate, there is still a significant portion which are based on filmic substrates. One of the most important label applications for filmic release liners is for so-called ‘clear-on-clear’ labelling, where the optimum label properties are achieved with a combination of transparent materials (transparent facestock, pressure sensitive adhesive (PSA), and release liner).

There are several different substrates used for filmic release liners in labelling applications such as polyester (PET), polypropylene (PP) and polyethylene (PE). Of these, by far the most commonly used is PET.

In terms of regional differences regarding the use of substrates, the North American region has the highest use of filmic materials as release liner, while the European region is much lower in terms of filmic release liner use. In all regions, however, the growth rate of film-based release liners in label applications is clearly greater than that of paper-based release liners.

In terms of their manufacture, filmic release liners can be produced using a similar process and conditions as are used for paper release liners, where a pre-formed filmic substrate is coated with a layer of silicone formulation that is subsequently crosslinked to form the final release coating. For filmic based release liners, however, there also exists a second option where the silicone release coating is applied as an additional layer during the film extrusion and forming process.

PART B – CAN SILICONE COATED FILMIC RELEASE LINERS BE RECYCLED?

Once the self-adhesive label has been removed from the release liner and applied to the final surface, the silicone release liner plays no further role in the labeling process and is ready to be recycled or re-used.

Filmic silicone release liners, like many other grades of polymeric films, can be (and are already being) recycled. The main challenges in recycling silicone coated films are related firstly to the overall level of silicone coating on the release liner, and secondly to any contamination of the recycling stream with ‘other’ materials (such as printed labels or adhesives from the label construction).

As stated before, filmic silicone release liners can be produced either by means of an “in-line” process where the silicone is applied to the film during film production process (prior to stretching process), which leads to generally very low levels of silicone coating, or by means of an “off-line” process where following on from film production the film is then mechanically coated with silicone (usually at a higher silicone coat weight).

When it comes to recycling the silicone coated film, the process is very similar regardless of whether ‘in-line’ filmic release liner or ‘off-line’ filmic release liner is being recycled, but there are some differences in the types and levels of non-filmic materials which can be tolerated. Like many other grades of film, silicone coated filmic release liners are recycled by regrinding the film into chips/pellets which can then be mixed with ‘virgin’ polymer and re-introduced to a film extrusion line for production of new polymeric film.

RECYCLING OF “IN-LINE” FILMIC SILICONE RELEASE LINER

It has already been well established that it is feasible to recycle filmic silicone release liners that are produced using an ‘in-line’ process back into the production of base film. It is important, though, to avoid contamination of the release liner waste stream with other materials such as self-adhesive filmic labels. Low levels of filmic self-adhesive labels (1-2%), may be tolerated in the film recycling process, but paper labels must be *completely avoided* as these can clearly disrupt the recycling of silicone coated films back into base film, even at very low levels.

RECYCLING OF “OFF-LINE” FILMIC SILICONE RELEASE LINER

When it comes to the recycling of ‘off-line’ filmic silicone release liners (where the silicone coat weights being applied are typically much higher than in-line produced liner), it is important to be aware of the potential impact of these higher levels of silicone on the recycling process, especially the film extrusion and stretching process. It may be necessary to dilute the silicone coated filmic release liner with virgin polymer. Typical processes being run today can tolerate levels of up to 25% silicone coated release liner mixed with virgin polymer.

PART C – END USES FOR RECYCLED SILICONE RELEASE LINER

The next question concerns the end uses for filmic polymer resin coming from the recycling of filmic silicone release liners. Are there limitations on the uses of this recycled resin?



As has already been highlighted, silicone release liners based on filmic substrates can be recycled back into the film production process. Whilst there are challenges regarding the tolerable levels of silicone in the recycling process, recycling of the film as feedstock for film production is definitely possible.

RECYCLING INTO RELEASE LINER BASE

The most common approach is to simply recycle the filmic silicone coated release liner back into the production of base films which can be used once again for production of filmic silicone release liners. This is reasonably straightforward as a process and the final film grades can be utilized for the same applications.

RECYCLING INTO ALTERNATIVE PRODUCTS

While it is technically possible to recycle filmic silicone release liners back into raw materials for other production processes, this is generally less preferred due to concerns over the potential impact of silicone residues on the end products (an example here might be the production of textile fibers from recycled film), and the inherently lower price levels for raw materials entering these alternative markets. Despite this, recycling into alternative polymer products saves the material from a landfill and lowers the demand for virgin material feedstocks. Recycling therefore should be pursued over landfilling in any case.

ABOUT CELAB

CELAB: Toward a Circular Economy for Labels is an industry initiative founded by companies in the self-adhesive label industry to create greater circularity for its products by enhancing and promoting matrix and release liner recycling around the world. For additional information on CELAB, including a full list of CELAB members companies and activities, visit www.CELABGlobal.org.

CELAB thanks all the members of the Technical Workstream who contributed to this report.

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