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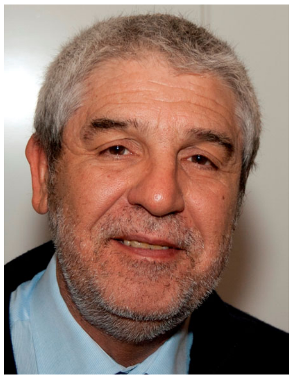

NEW INSIGHTS INTO THE INFLUENCE OF ADHESIVE THICKNESS ON TACK AT 20 ºC IN HOT MELT PRESSURE SENSITIVE ADHESIVES SUPPORTED ON PAPER

ABSTRACT

Pressure sensitive adhesives (PSAs) are commonly used in packaging and labelling. PSAs are generally supported on different carriers (paper, polyethylene, polypropylene) for producing labels.

Tack is one of the key properties of PSAs which is influenced by temperature, adhesive thickness, equipment used (loop tack, Rolling tack, probe tack) and measurement conditions (pressure during contact, dwell time, rate of detachment) [1]. Whereas the influence of the most of these parameters have been previously studied, the incidence of the adhesive thickness on tack has been scarcely addressed. The most few studies carried out to date have been made in acrylic PSAs and they have shown that the tack increases by increasing PSA thickness [2,3], but some literature evidenced the opposite trend [4]. Furthermore, the influence of the carrier of PSAs on tack has not be sufficiently considered yet. Therefore, in this study, the variation of tack at 20 ºC with the adhesive thickness (50, 100 and 200 µm) of hot melt PSA supported on paper (PSA/Paper) was studied. The tack was measured by using the probe tack method. As reference, non-supported bulk hot melt PSA of 200 µm thickness (bulk PSA) was prepared. In order to correlate the variation of tack with the changes in surface energy and, particularly, chemistry on the adhesive surfaces of PSA/Paper, they were analyzed by water and di-iodomethane contact angles, and ATR-IR and Raman spectroscopy.

The tack at 20 ºC (taken at the maxima of the stress vs displacement curves) of PSA/paper decreases by increasing the adhesive thickness. Furthermore, for the same adhesive thickness (200 µm), the tack at 20 ºC of PSA/paper decreases significantly with respect to the one on bullk PSA (Figure 1). The shape of the tack curves at 20 ºC of PSA/Paper varies with the adhesive thickness, and the maximum displacement becomes larger with the increase of adhesive thickness (Figure 1).

These variations can be ascribed to the balance between non-linear variation of the strain rate and the different orientation of the polymer chains located at the probe-PSA and PSA-carrier interfaces. The water contact angle value at 20 ºC on PSA adhesive decreases from 94º (bulk PSA) to 91º when supported on paper (PSA-200 µm/Paper), and the contact angle values of PSA/Paper vary slightly (88-91º) with the adhesive thickness and they are more similar to the one on paper (91º). The lower contact angle values on PSA/Paper can be ascribed to increased polarity with respect to the paper and the bulk PSA. In fact, the ATR-IR spectra of PSA/paper with different adhesive thickness show different intensities of C-O (1743 cm-1) and C=O (1242 cm-1) stretching bands (Figure 2). The ratio of the intensities of those bands (IC=O/IC-O) is lower in PSA/paper with adhesive thicknesses of 100 and 200 µm than in bulk PSA, but higher in PSA/paper with adhesive thicknesses of 50 µm (Figure 3)..

In summary, the paper support (carrier) reduces the tack at 20 ºC of hot melt PSA due to higher surface polarity due to enriched C-O species on adhesive surface. Furthermore, the

decrease of the adhesive thickness in PSA/paper improves the polar component of the surface energy and reduces the dispersive component of the surface energy, in a different manner particularly between 50 and 100 µm.

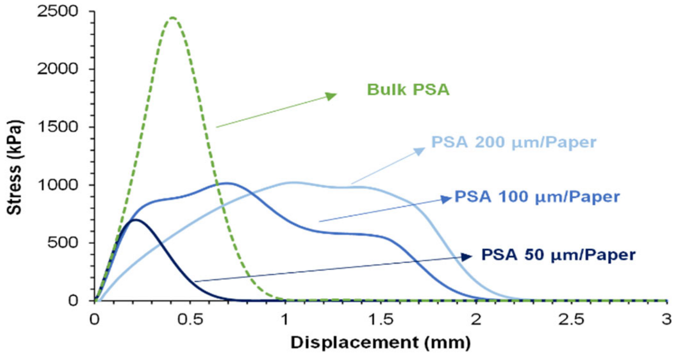

Figure 1:
Variation of stress vs displacement at 20 ºC of bulk PSA and PSA/paper with different PSA thickness.

ATR-

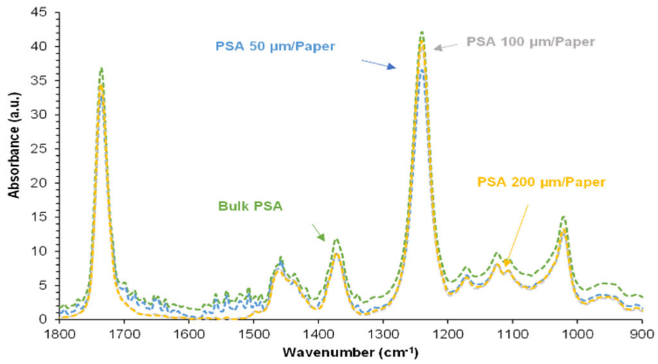

Figure 2:
IR spectra of bulk PSA and PSA/paper with different thickness.

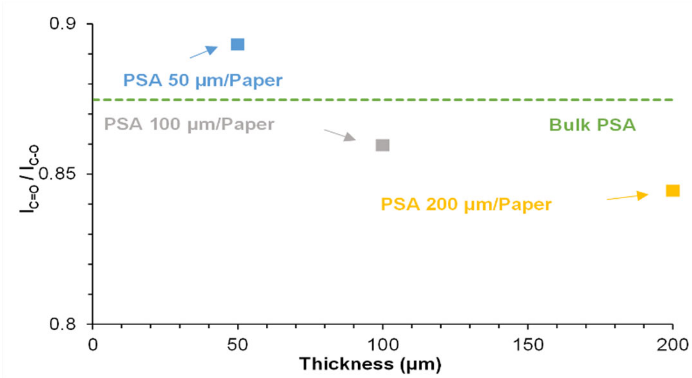

Figure 3:
Variation of the ratio of intensities of C=O (1743 cm^{-1}) and C-O (1242 cm^{-1}) – $I_{C=O}/I_{C-O}$ - bands vs adhesive thickness of bulk PSA and PSA/paper with different adhesive thickness.

References

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