

Durable goods

How to label challenging surfaces.



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Choosing a labelling material is simple for many general applications, because they involve clean, dry, receptive surfaces at room temperature. Decisions centre on aspects such as shelf appeal and brand image, and converters have confidence that labels will not become detached or damaged.

The world of durables labelling is far more complex, especially in segments such as automotive, domestic appliances and electronics. Labels often have to resist exposure to harsh conditions including high temperatures, cleaning agents and automotive chemicals. Crucially, the substrates involved in some cases offer poor levels of adhesion for conventional adhesives (sometimes made still worse by textured surfaces), and yet the labels have to adhere for the lifetime of the products – often measured in many years. A change such as switching to a new case material – for example, making it lighter and easier to clean – may present additional problems. This can cause a previously reliable label to perform poorly and in the worst case fall off entirely.

Finding the right labelling material for a particular application depends on understanding what affects label adhesion and endurance.



Factors that determine adhesion

Three main characteristics determine the ease with which a surface can be labelled:

- ▶ Surface energy
- ▶ Roughness
- ▶ The presence of contamination

Surface energy

Surface energy is a somewhat scientific concept, but essentially it shows how easily a surface will allow something to adhere to it. For example, a freshly waxed car has very low surface energy, which can be seen by the fact that water forms small droplets (rather than spreading out across the surface, as you would see on dull paintwork). The same effect can be seen when using an adhesive – a low surface energy substrate is difficult for an adhesive to ‘wet’, which means that specialist adhesives are required.

Metals have high surface energies and are easy to label. Plastics have much lower surface energy values, as can be seen from table 1 (unsurprisingly, ‘non stick’ Teflon® is at the bottom of the list as one of the most difficult materials to label).

Roughness

On smooth substrates, an adhesive can spread out onto the entire surface, making contact at all points and achieving a high area of coverage. On rough surfaces, the adhesive can only reach the upper parts of the irregular structure, and these parts can be a small fraction of the entire surface. The solution to this problem is to use more adhesive and/or an adhesive that flows well. A label with an increased coat weight or ability to flow will improve adhesion by covering a larger area.

<u>Material</u>	<u>Surface energy</u> (dyn/cm)
Typical metal	Over 500
Polyamide (PA6, PA66)	43
Polyethylene terephthalate (PET)	43
ABS	42
Polycarbonate (PC)	42
Polypropylene (PP)	32
Polyethylene (PE)	31
PTFE fluoropolymer (Teflon®)	18

TABLE 1: EXAMPLE SURFACE ENERGIES
(LOWER FIGURE = MORE DIFFICULT TO LABEL)

Contamination

Dust, rust or oil contamination will also make a surface difficult to label. With similarities to a rough surface, the overall effect is to reduce the amount of direct contact between the adhesive and the surface. Adhesives that flow well are required to overcome this.

Choosing an adhesive

Durable goods labels must stay in place on challenging substrates, and they also often have to withstand heat and chemical exposure over long periods. Rubber-based adhesives adhere well, but do not offer the right resistance to chemicals and temperature variations. General purpose acrylic adhesives offer long-term resistance, but do not adhere well to challenging substrates.

Avery Dennison offers two solutions to this challenge: rubber hybridised acrylic (RHA) adhesives for ultimate performance; and a high-tack emulsion-based acrylic adhesive for excellent adhesion and durability in demanding – but not extreme – conditions.

Rubber hybridised acrylic adhesives

Avery Dennison's S8029, S8039 and S8049 adhesives use rubber hybridised acrylic (RHA) technology to improve performance beyond that of a conventional acrylic adhesive. An acrylic network gives high cohesion and strength, and domains of rubber ensure high levels of adhesion on low surface energy substrates. These adhesives offer significant benefits:

- ▶ Extremely high peel adhesion on difficult surfaces
- ▶ Extremely high resistance to chemicals, temperature, UV, ageing
- ▶ Compliance with automotive specifications
- ▶ UL and C-UL recognition

Different coat weights are offered by Avery Dennison for different surface textures (S8029 = 27 gsm, S8049 = 45 gsm, S8039 = Mix and Match solution, 27-40 gsm). S8049 suits the roughest and most challenging surfaces, while S8029 can be used for a wide range of applications where a high tack, long lifetime adhesive is required.

High tack emulsion-based acrylic adhesive

Avery Dennison S8002 is a sophisticated adhesive for difficult surfaces under non-automotive conditions. This high tack emulsion-based acrylic adhesive performs well in durables applications, providing good peel adhesion on low surface energy substrates. An adhesive coat weight of 27 gsm means it can also cope with slightly rough surfaces. Peel adhesion, tack and chemical resistance are lower than S8029, but S8002 is more competitively priced. S8002 especially suits household appliances and electronics (and products using S8002 have obtained wide UL and C-UL recognition).

Materials using RHA adhesives

<u>Code</u>	<u>Product description</u>
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AJ059	Transfer PET white TOP - S8049 - BG42wh BSS
AL852	Transfer PET matt chrome TOP - S8049 - BG42wh BSS
AL854	Transfer PET matt white - S8049 - BG42wh BSS
AJ060	Transfer PET matt silver - S8049 - BG42wh BSS
BN947	Transfer PET white TOP - S8029 - BG45wh
BH781	Transfer PET matt chrome TOP - S8029 - BG45wh
BN949	Transfer PET matt white - S8029 - BG45wh
BN950	Transfer PET matt silver - S8029 - BG45wh

Materials using S8002 acrylic adhesive

<u>Code</u>	<u>Product description</u>
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BL805	Transfer PET white PT - S8002 - BG42wh
BJ330	Transfer PET white TOP - S8002 - BG42wh
BL799	Transfer PET matt chrome TOP - S8002 - BG42wh
BL802	Transfer PET matt white TC6 - S8002 - BG42wh
BN104	Transfer PP TR 75 matt white - S8002 - BG42wh

Example applications

Understanding how to make the right adhesive choice can be illustrated with two examples.

Automotive fluid container

These containers are made out of HD-PE with a rough surface – an extremely challenging substrate. The application is made yet more difficult by exposure during the product's lifetime to high temperatures and chemicals. S8049 proved to be a very successful choice, giving high peel adhesion, oil/chemical resistance and high temperature endurance. Transfer PET white TOP - S8049 was qualified in this case, following extensive testing.



Household appliance

The less demanding (but still challenging) conditions presented by consumer electronic devices have been successfully addressed using S8002, which delivers high tack and good peel adhesion on low surface energy substrates. Its adhesive coat weight of 27 gsm allows it to cope with slightly rough surfaces, and its price point is lower than RHA adhesives. S8002 also offers essential UL and C-UL recognition. This example application used Transfer PET matt chrome TOP - S8002, which was qualified for labelling the rear of the device. The material gave excellent adhesive performance on the matt ABS plastic, along with good temperature and humidity stability.



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