B.5.5. Avantages des résines thermofusibles pour l'étanchéité et le collage de recouvrement d'écrans métalliques utilisés dans les câbles d'énergie

BUTTERBACH R., Henkel KGaA, Düsseldorf, Allemagne
HEUCHER R., HENKEL Corp., La Grange, Etats-Unis

Résumé
Dans le cas d'une structure de câble Energie intégrant un écran métallique, l'étanchéité et le collage de recouvrement doivent être réalisés à l'aide d'un adhésif. Les changements importants de température enfonctionnement créant des déplacements physiques du recouvrement, seul un adhésif à comportement liquide visqueux à haute température parait satisfaisant. Les principales caractéristiques des résines thermofusible à base polyamide PA, éthyléne-acétate de vinyle copolymère EVA, polypropylène attactique APP et élastomères thermoplastiques ETP, sont comparées.

B.5.5. Advantages of hot melt adhesives for overlap bonding and sealing in power cables

BUTTERBACH R., Henkel KGaA, Düsseldorf, Germany
HEUCHER R., HENKEL Corp., La Grange, USA

Abstract
If power cables are designed with aluminium or copper shields, the overlap seam has to be sealed by an adhesive. Because of the potential movements of the overlap as a result of temperature changing, only an adhesive with a high viscous liquid like behaviour at high temperatures shows well balanced properties. The main properties of hot melt adhesives blend based on polyamide PA, ethylene-vinylacetate-copolymer EVA, atactic polypropylene APP and thermoplastic elastomere TPE are compared.

The cable sector is splitted up in two areas, power and telecommunication cables. The power cables are distinguished between high, medium and low voltage cables with special requirements for each type. In high voltage cables, insulated with polyethylene (PE) shield, moisture penetration creates electrical failures, because of the „water treeing effect", an electrochemical behaviour in strong electrical fields.
Standard energy cables are prevented from damaging due to this effect by installing an additional metal shield. In this case the metal shield works as a moisture barrier. Power cables are usually designed with aluminium or copper shields with an overlap seam in longitudinal axis. Such a design without any sealing in the overlap is not a perfect solution. Water can penetrate through the unsealed overlap.
The temperature conditions in energy cables change during working. There can be a temperature range from room temperature to 90 °C. The potential movement of the overlap, a result of temperature changing, has to be noted. This movement is described in figure 1:

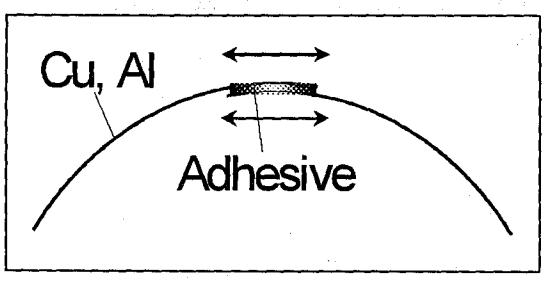

Figure 1: Movements of the overlap.

The dimension of these movements depends on the material, the increase of the temperature difference and the diameter of the construction. A theoretical approximation for the quantity of the possible overlap width change is shown in the following figure. This calculation is based on a minimum overlap width of 8 mm respectively 15 % from the shield diameter. The figure 2 shows the movement in dependence on the shield diameter.

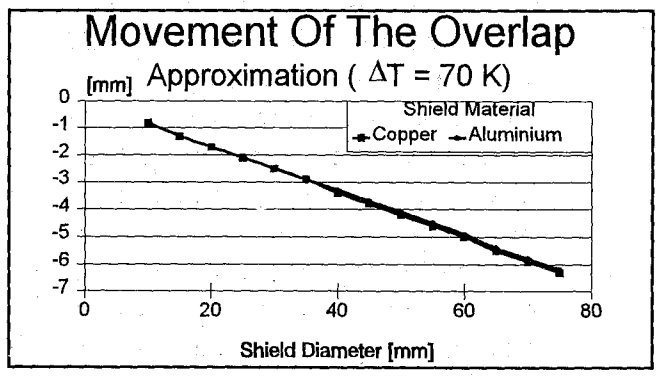

Figure 2: Possible movements of the overlap (ΔT = 70 K).

Concerning to this movement it is difficult to find an adhesive which works close to this behaviour.

There are some possible solutions to get a sealed overlap.

Option 1:	Use of a sealant with high elastic behaviour (e. g. rubber mastic). - Not enough adhesion to the substrate.
Option 2:	Use of an adhesive with high structural bonding (e. g. epoxy system). - Not enough movement of the overlap possible.
Option 3:	Use of an adhesive with viscoelastic behaviour. (e. g. hot melt adhesive). - Enough adhesion to the substrate. - Movement of the overlap possible.