Cyberbond xtraflex Series - partly flexible Cyanoacrylates (CB 2240, 2241, 2242)

Cyberbond xtraflex Cyanoacrylates withstand dynamic loads

Continuous miniaturisation of parts, which have to be bonded especially in the electronic industry, have led to much a higher stress requirements (percentage wise in terms of surface area) in the adhesive bond layer.

The development of Cyanoacrylate adhesive chemistry over the years has resulted in high static strength figures being achieved, modern bonding techniques and assemblies however, have made this achievement largely irrelevant as the performance of the adhesive joint under dynamic load conditions is much more important.

Modern partly flexible adhesive grades like the Cyberbond xtraflex series give better results and open new areas of application for this type of adhesive, especially in plastic to plastic, plastic to metal as well as elastomer bonding applications.

In the past Cyanoacrylate adhesives had been used in spite of their high dynamic strength figures of 22 to 25 N/mm² only as a mounting aid and the performance envelope of these adhesives where never usually pushed to the maximum. Today it is different because, as the components to be bonded get smaller and smaller, the stress on the bond layer is getting much higher (relative to the bond area). Therefore in many modern bonding components the adhesive joint is overloaded. To avoid this, careful consideration and calculation of the stress in the joint should be undertaken in the laboratory.

In such investigations it was clearly shown the importance of partly flexible Cyanoacrylates, which create good strength levels and place themselves in between the rigid low viscosity Cyanoacrylates and the high viscosity, often thixotropic and slow curing products. The importance of these products is highlighted greatly in applications where the adhesive joint is exposed to varying temperatures, or if the two bonded materials have different thermal expansion co-efficient or even worse the adhesive joint is exposed to humidity and water. Standard Cyanoacrylates simply would not be able to withstand these conditions due to their inherent stiffness.

Although on many adhesive joints the stress is absorbed by one of the substrates such as rubber to metal bonding often the cause of bond failure is due to the adhesive layer in the joint being to thick.

Adhesives in comparison

Furthermore if rigid parts have to bonded and are subjected to thermal cycling as in Diagram 2, it is pretty obvious to see that after 5 cycles of 100°C and −20°C the partly flexible Cyanoacrylate CB 2240 retains much more of its initial strength some 52 percent, whereas the standard ethyl ester based Cyanoacrylate only retains 28 percent.

On stainless steel test pieces as in Diagram3 after a full cure and climatic load, a dramatic difference is observed in the mechanical and chemical stress resistance achieved between CB 2240 and the standard ethyl ester product. Furthermore CB 2240 product shows a shear value of around 22 N/mm² and conclusively this strength was neither heavily influenced by adhesion or cohesion failure.
Stainless steel was chosen for this illustration as the absence of surface oxidation (corrosion during the test procedure) gives a true reflection of adhesive bond performance. In practise it is already proven that in harsh environmental tests (such as salt spray tests) adhesive joints made with a **Cyberbond xtraflex series** grade can withstand also water diffusion. *Picture 2* shows a steel reinforced rubber profile after a salt spray corrosion test has been performed. Only areas which have not been totally covered with the semi flexible Cyanoacrylate adhesive exhibiting corrosion –the rest stay in place and are not only cosmetically perfect. The difference in flexibility can also be clearly illustrated by a common peel test *diagram 1* shows this. The test was conducted on ST37 steel with an average bonding thickness of 0.05mm the semi flexible product shows enhanced peel strengths. This is inherently due to its more flexible nature, as the products tested here both had the same viscosity.

**Practical applications of semi flexible Cyanoacrylates**

*Picture 3* shows a conveyor belt application. The belt is constructed from a reinforced fabric material and is jointed using a special overlap technique using a semi flexible Cyanoacrylate (Manufacturer Siegling, Spain). Exhaustive tests have shown that a joint made in this way with a **Cyberbond xtraflex product** can fulfil all the requirements of durability, temperature resistance and environmental resistance required.

In practice the user will notice that the set speeds of these modified products are not significantly slower than normal Cyanoacrylate adhesives. Nevertheless all reactive adhesives based on Cyanoacrylate chemistry rely completely on the moisture content of their surroundings to determine their cure speed.

Another benefit of **Cyberbond’s xtraflex products** is their gain in temperature resistance over standard ethyl ester products. *Diagram 3 and 5* show this clearly. Short-term heat resistance in terms of shear strengths is increased dramatically. Even though cured Cyanoacrylate polymer is inherently thermoplastic in nature.

**Conclusion**

Semi Flexible Cyanoacrylates with their inherent strengths such as temperature, mechanical and chemical resistance combined with the high speed bonds they produce, offer some interesting and exciting possibilities for this type of adhesive. Many existing and new industrial applications may benefit from the use of this type of product, especially as this technology is developed further with the introduction of new products. To fully exploit this technology equipment manufacturers have already developed applicators to ensure small thin layers of this adhesive can be put down in production. An example of this combined technology is the smart card industry for module insertion (*Picture 4*). Using a **Cyberbond xtraflex grade** combined with appropriate **Cyberbond LINOP series** application equipment has allowed the high-speed production speeds necessary for this type of product, combined with the bond strength necessary for this security feature.
Shorterm Temperatureristance at 150 °C

Strength at different Temperatures