

## **POLYSULFIDE SEALANTS FOR INSULATING GLASS: FENZI THIOVER QUALITY PROVES TO BE TOP OF THE CLASS**

The current globalization of our economy has had the striking effect of providing a multitude of competing businesses access to a single market sector. Even insulating glass manufacturers have been affected by this new situation, so much so that it has become increasingly difficult for them to differentiate and evaluate in a fast and reliable manner the real quality of the products they use. At the same time, the complexity and delicate nature of insulating glass units has grown considerably due to the continuous development of the components being used (float glass, low-emissivity glass, space bars, installation sealants, etc.). In this setting it is now much more important than ever to use high-quality sealants with guaranteed long-lasting performance.

Fenzi has risen to meet this challenge by presenting a comparison study on the products available on the market in order to make it easier for their customers to recognize the true qualitative differences of the various products. Thus Fenzi has performed comparison tests between its own THIOVER sealant and a large number (almost all) of the other products marketed worldwide which appear, at least on paper, to be similar.

All the characteristic factors of sealants have been taken into consideration:

- Chemical Composition
- Application properties
- Physical performance and its retention after ageing cycles

### **CHEMICAL COMPOSITION**

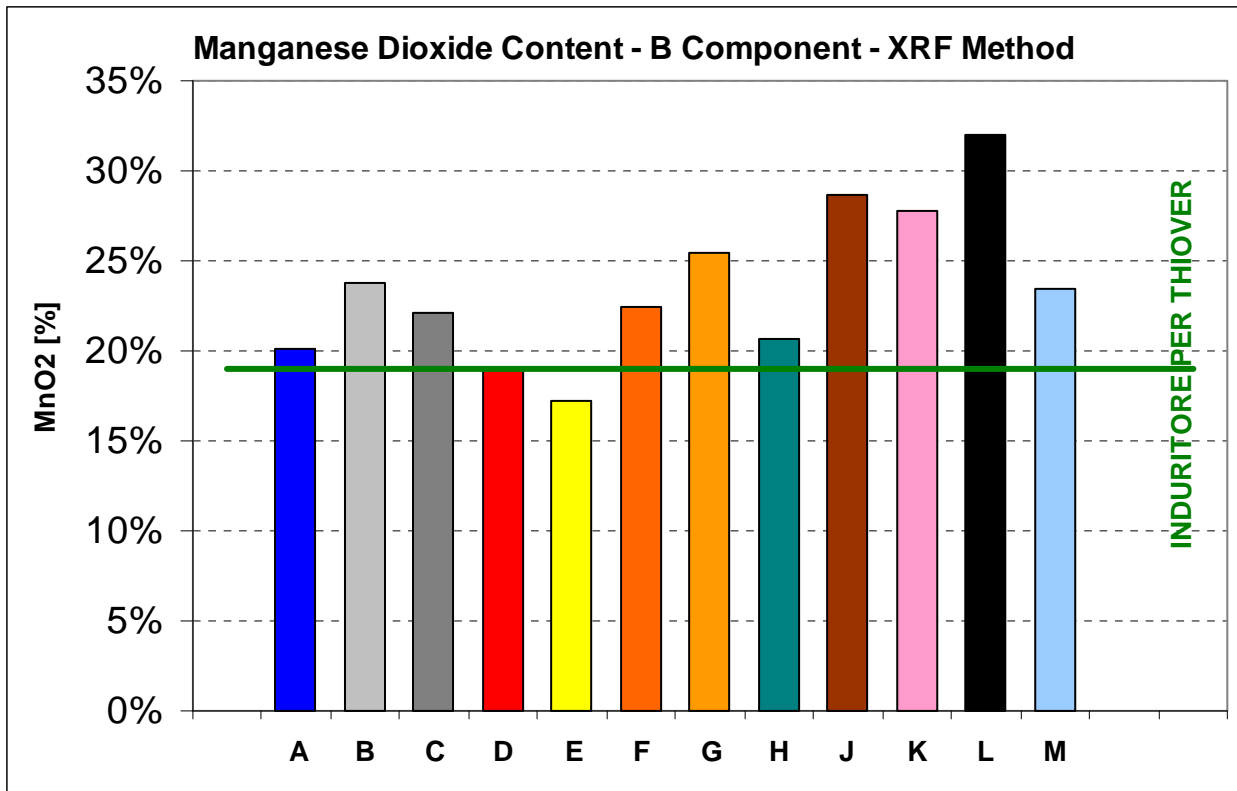
When considering possible formulations, the selection of the components, their origin and the respective quantities naturally play a key role in the performance of a product.

And then there are new regulations that limit or even ban the use of some substances. In fact, Europe has recently seen the introduction of a list of SVHC substances (Substances of Very High Concern for health and the environment), some of which have still been found in certain samples analyzed for this study. Of course these are sealants coming from extra-EU markets where these regulations are not applied and, consequently, the products containing these substances do not have to be classified as Toxic.

Fenzi has always taken great care with regard to the toxicological and ecological aspects of all its products, and the THIOVER Polysulfide sealant is actually one of the few sealants for insulating glass which is not required to be labeled with hazard symbols pursuant to the current European Directive (67/548/EEC).

This has been achieved by also formulating the B component (catalyst) with low concentrations of Manganese Dioxide (Noxious Xn), which ensures the proper catalysis without compromising the performance of the sealant even when the mixing ratio is different than the ideal stoichiometric value.

All the samples have been analyzed using X-Ray Fluorescence to determine their Manganese Dioxide concentrations. The results provided in the table below confirm that the Fenzi B component (the Hardener for Thiover) falls among those with the lowest harmfulness for users.



The graph clearly shows that samples G, J, K and L contain a very high amount of Manganese Dioxide, while samples B, C, F and M also have a significant amount of MnO<sub>2</sub> with respect to the other samples. Sample E, on the other hand, has the minimum concentration of MnO<sub>2</sub>.

**Note: High values of manganese lead to increased toxicity levels and thus require labeling as an Irritant (X).**

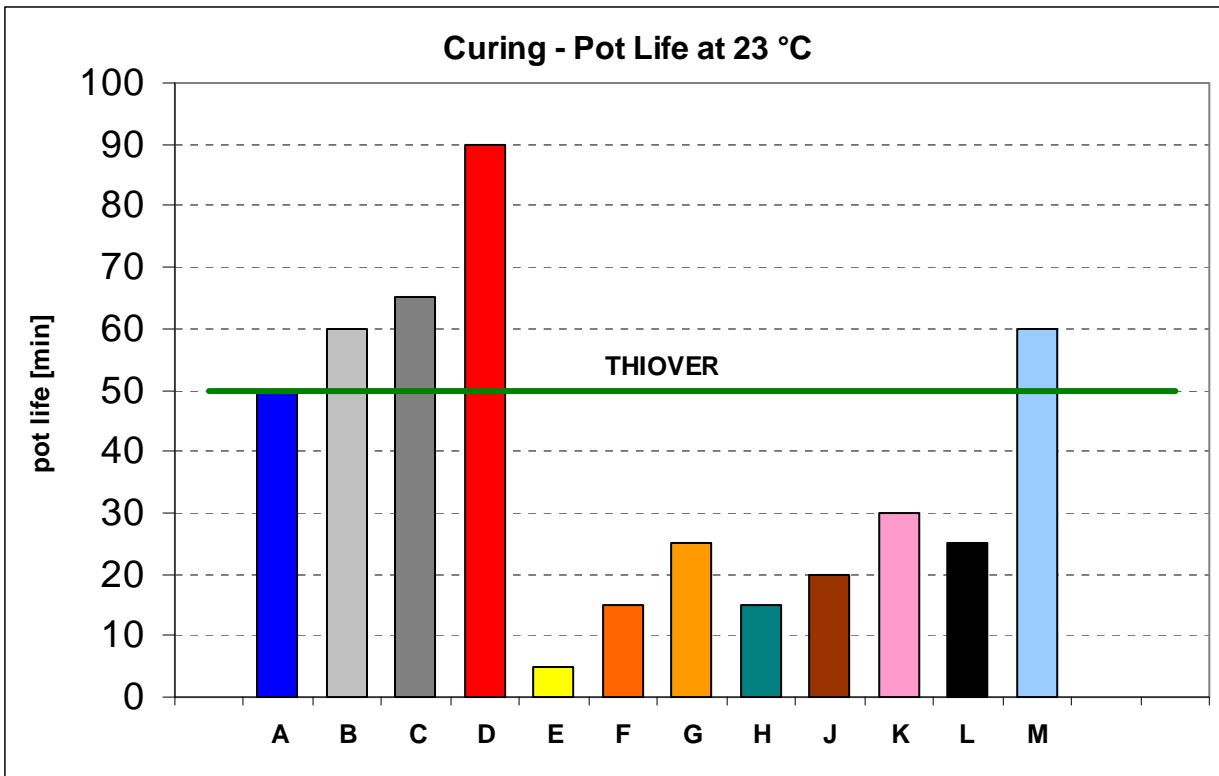
Contents which are too low, however, fail to guarantee proper curing when the supply of the B component is inadequate.

Thus a compromise between factors such as “stoichiometry”, guaranteed catalysis and ecological needs becomes essential in the formulation of the B component. This is the goal successfully achieved by Fenzi in fine tuning its Thiover hardener.

## APPLICATION PROPERTIES

These are the characteristics which are assessed mainly by sealant users and thus determine whether or not they are pleased with the product. Properties like *rheology*, *abrasiveness*, *pot life* and *catalysis* are checked continuously and, when optimal, guarantee low maintenance costs for the systems, cleanliness of the products and fast handling and shipping cycles.

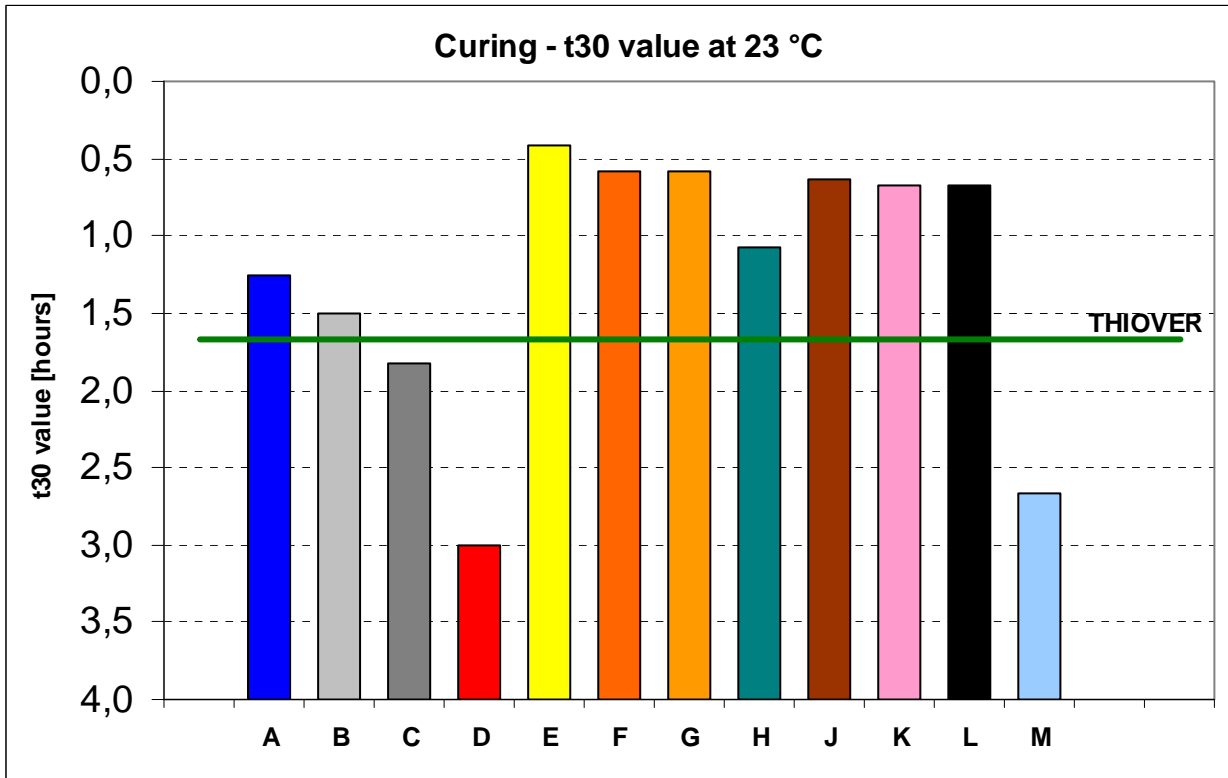
Some of the results obtained for these characteristics are presented below.



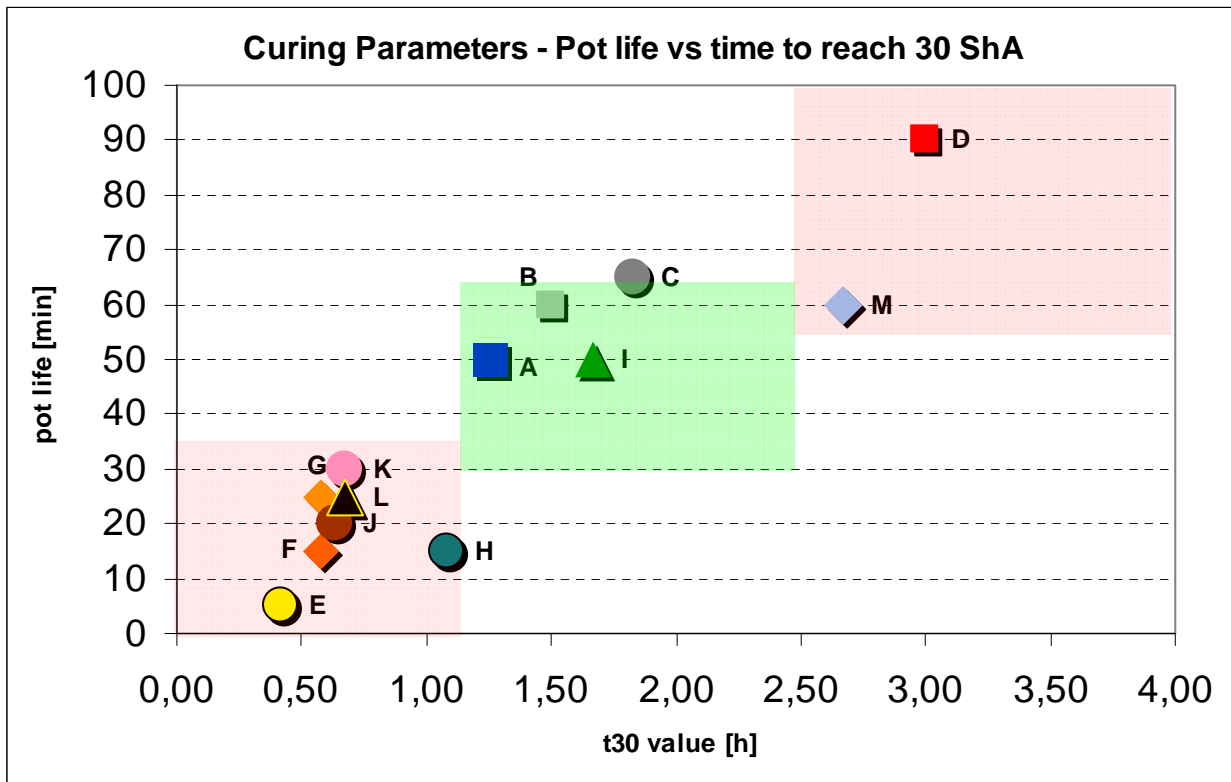
A long pot life has been found for sample D, while the shortest times have been found for samples E to L.

In order to avoid excessively long wait times before transport (slow catalysis) or problems related to fast catalysis such as clogging of the mixers in the sealing machines, a compromise between these two extremes must be reached.

**The graph above clearly demonstrates that the Fenzi sealant achieves this objective perfectly.**



The t30 value is the time required by the mixture to reach the hardness value of 30 Shore A (the minimum hardness considered essential for handling and transport of insulating glass units). Ideally this value should fall within the range from about 1 hour and 15 minutes to 2 hours and a half. **Thiover has a t30 value between 1.5 and 2 hours.**



I = FENZI Thiover Sealant

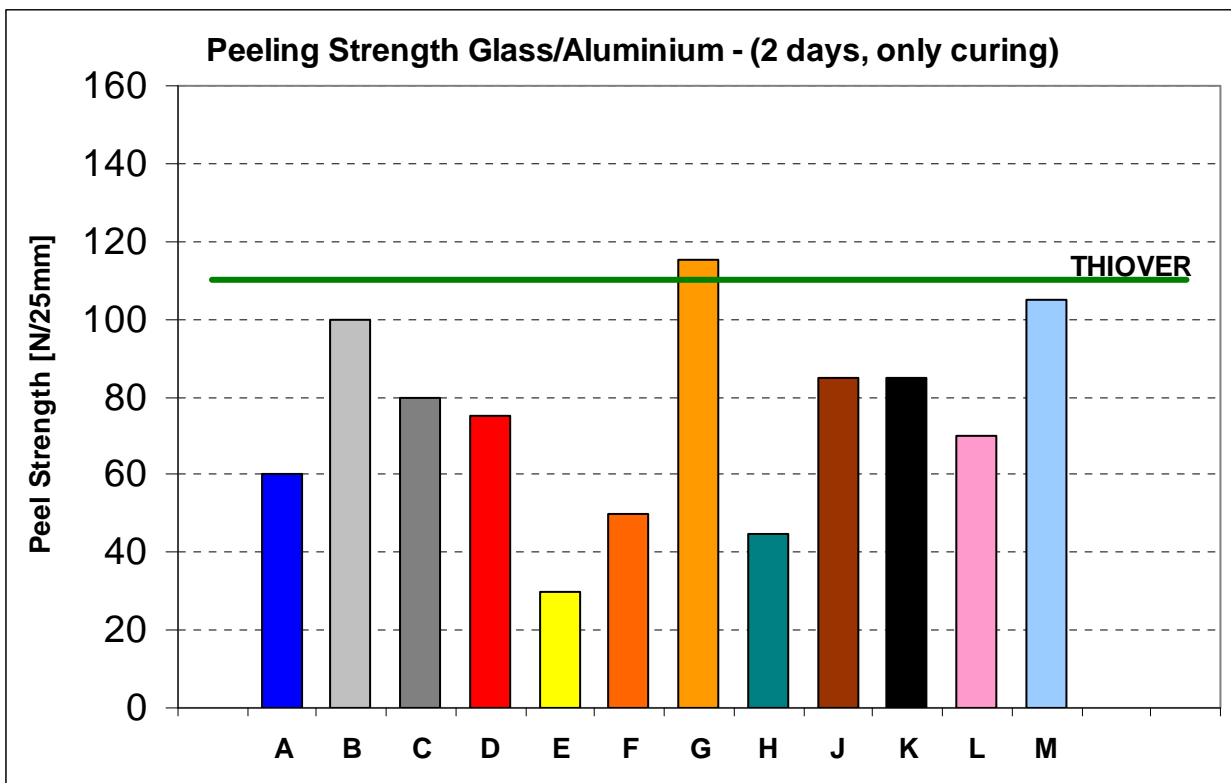
The graph above shows how the Pot Life and t30 value are related. **The green area is the “safety zone”** with the right compromise between the polymerization and product workability parameters. The samples in this area have both a proper pot life after mixing and acceptable wait times for handling the insulating glass units.

## PHYSICAL PROPERTIES AND THEIR RETENTION AFTER AGEING CYCLES

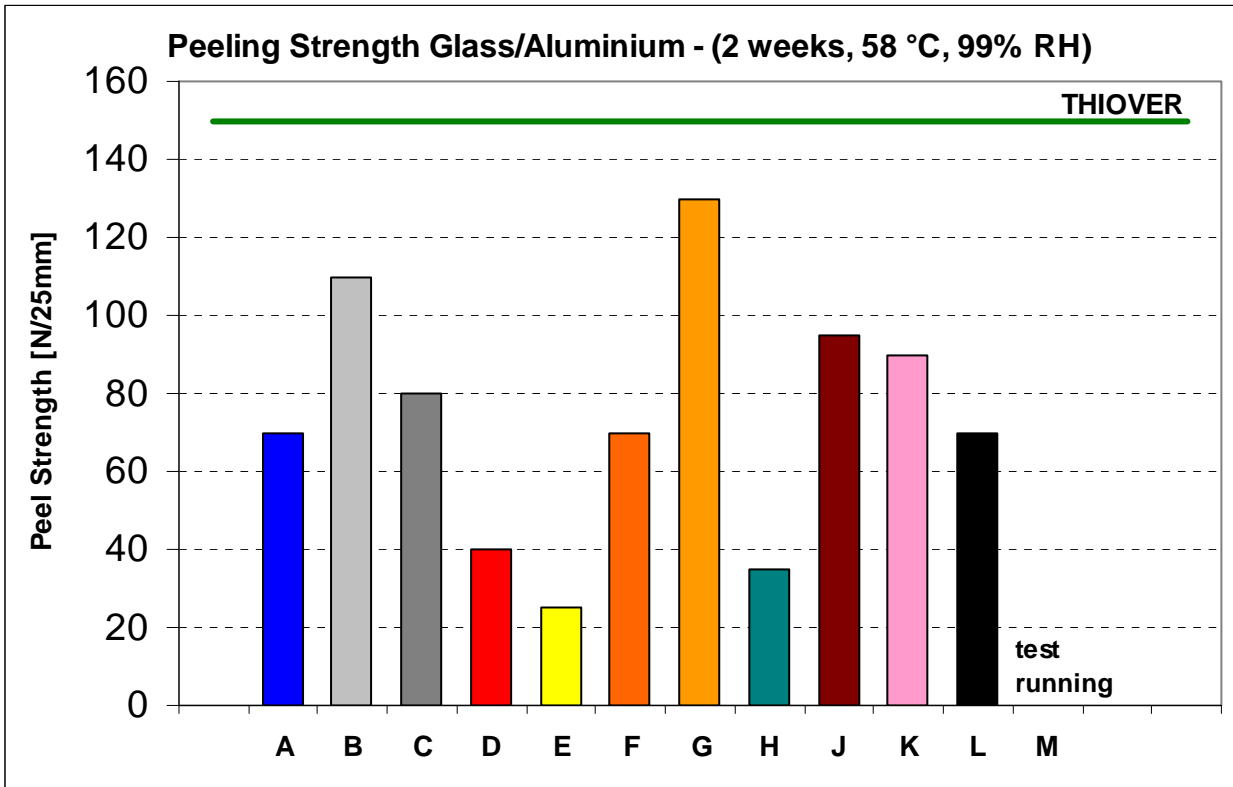
These are all those properties such as *water-vapor and gas permeability, adhesion to substrates (glass and spacer bar), mechanical strength (stress) and elongation at break (strain)* that clearly determine the performance of the insulating glass units and their service life once installed.

The long-term retention of these characteristics, with respect to the original values, in glass units subjected to adverse climatic conditions such as humidity, wind and direct sunlight characterize the true quality of a sealant.

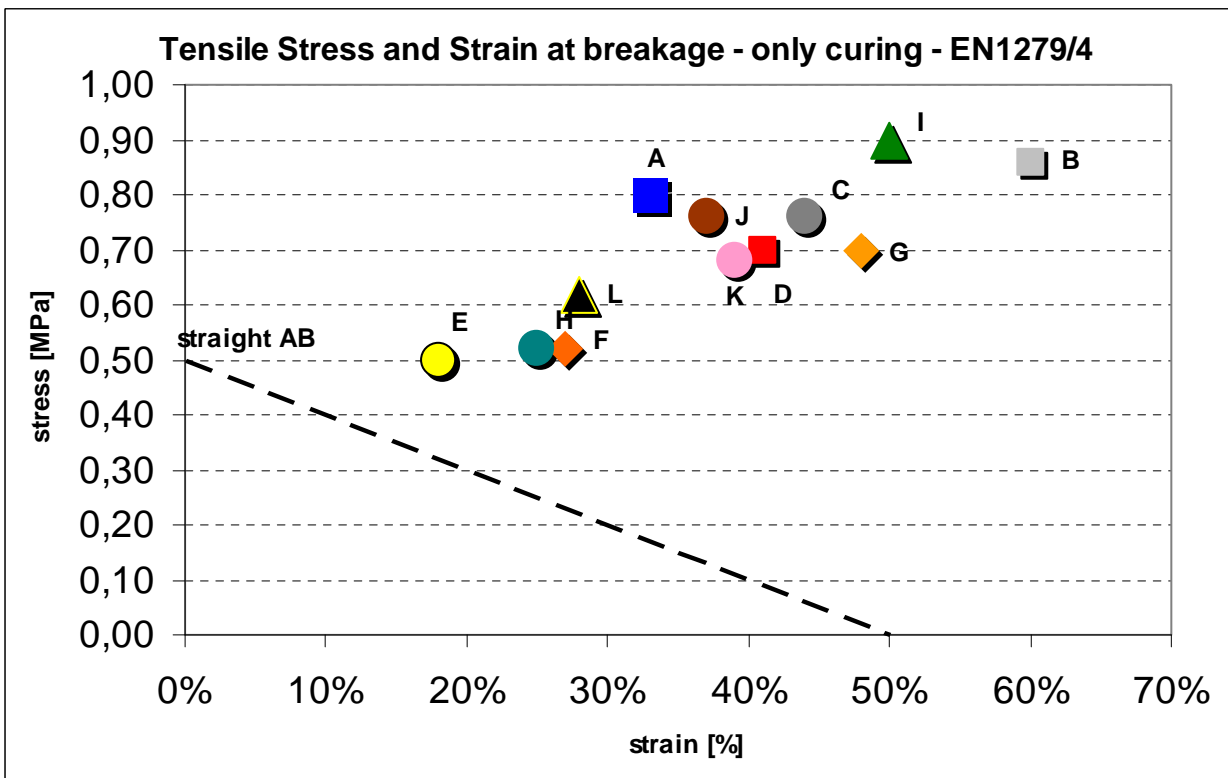
Some of the results obtained for these characteristics are presented below.

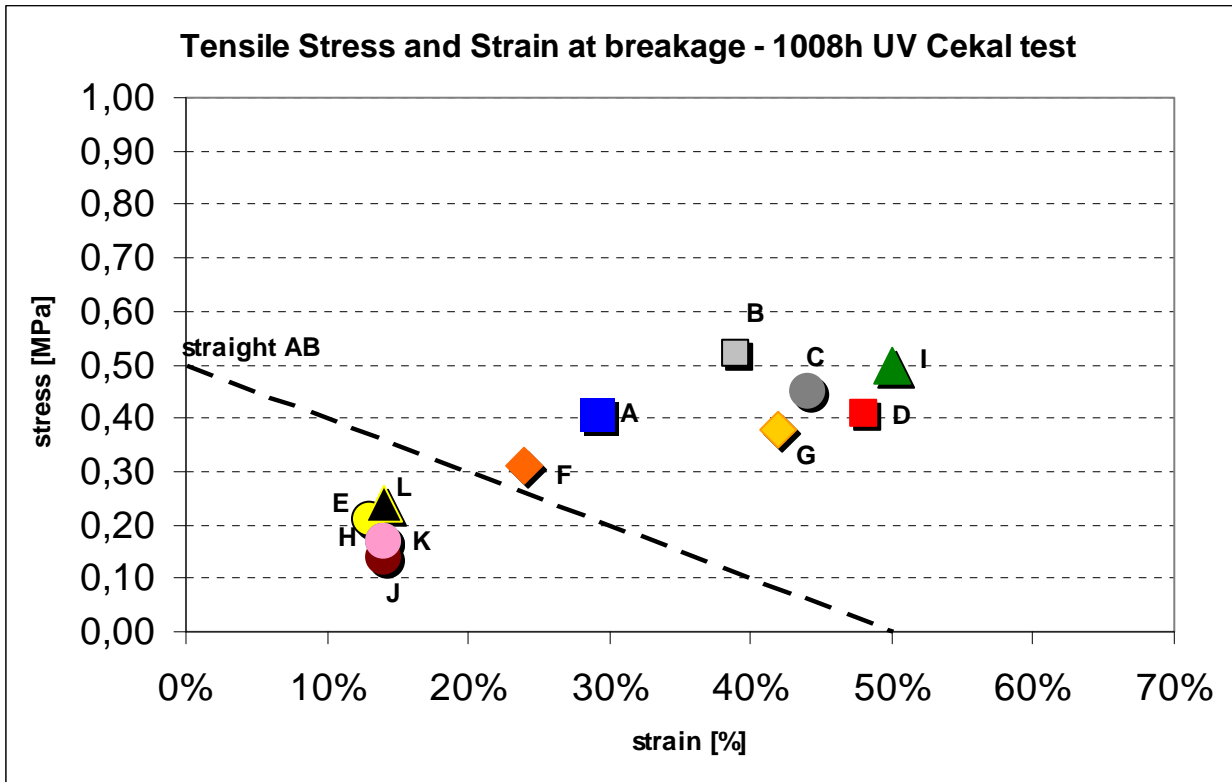


The glass/aluminum peeling test was carried out to assess the adhesive properties on both substrates. Samples B, G, M and Thiover show the best performance, while samples E, F and H demonstrated weak adhesion.



After the ageing process (humidity and heat), Thiover demonstrates the best adhesive performance. **Quantitatively, the Peeling Strength of Thiover is much higher than the values obtained with the other samples.** The worst behavior after the ageing treatment was seen in samples D, E and H. Cohesive breaking of 100% was observed for all the samples, except for E (30% adhesion on aluminum), H (only slight adhesion on aluminum) and D (no adhesion on aluminum).





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Tensile tests according to EN 1279-4 were carried out in order to evaluate the mechanical and adhesive properties of the different sealant samples. The parameters were evaluated on samples after catalysis (initial characteristics) and after a CEKAL ageing cycle (1008 hours UV, high humidity and heat). In order to meet the CEKAL requirements of the ageing test, the breakage of the samples must occur above the line AB (the line that connects the stress at 0.50 MPa and 50% strain).

The results demonstrate that after the ageing cycle many of the sealants (E, F, H, J, K, L) subjected to this test have values which are at or far below the minimum requirements threshold.

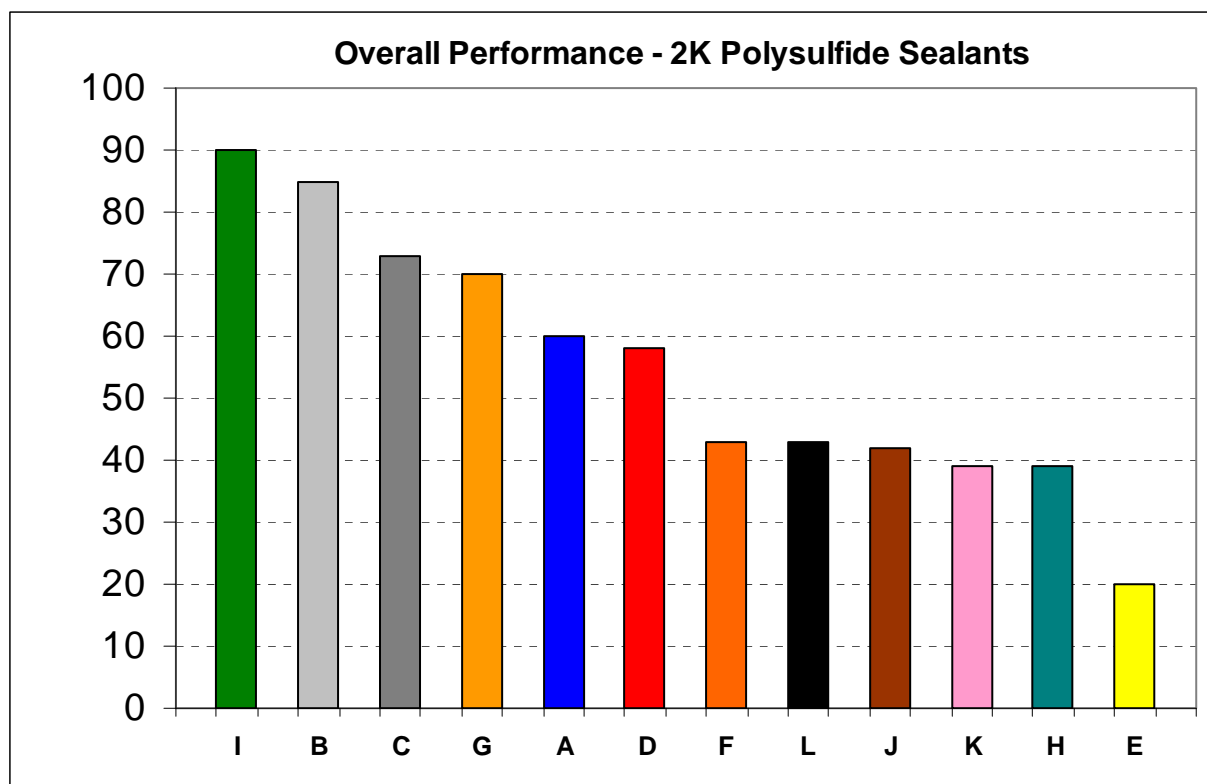
These products do not guarantee long-term retention of the humidity and gas seal of the insulating glass units after installation.

## CONCLUSIONS

This study has compared 13 2-Component Polysulfide sealants for insulating glass, for a total of 9 different manufacturers operating on the market. For each sample, twenty-four (24) key characteristics for determining the sealant's quality have been evaluated. When considered

necessary, analyses have also been carried out to identify the chemical nature of the substances contained in the samples.

Each characteristic examined has been given a “specific weight” that contributes to the overall assessment summarized in the histogram below.



As the results presented in this study and the overall ranking of the samples clearly demonstrate, the polysulfide sealant used for insulating glass should be chosen very carefully considering that there are several low-quality products available on the market, some of which even contain substances deemed harmful for health and the environment and banned in countries with more progressive regulations on the subject.

Finally, it can be stated that the FENZI Thiover sealant proves to be at the top of the class for its excellent physico-chemical properties, extreme ease of use and weatherability, including ultraviolet radiation.

Furthermore, Thiover has been designed and is currently produced in compliance with all European Regulations, with the utmost respect for the environment and using non-hazardous raw materials.