SMALL COMPANIES INVOLVED IN POLYMER TECHNOLOGIES: IS THERE FUTURE WITHOUT R&D

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Nowadays the small companies which are dealing with polymers or monomers are under a great pressure as consequence, among others circumstances, of the world economic crisis. There are many sources of problems for all formulators due to the lack of raw materials, the continuous fluctuations in the prices, the delivery times and strong competition with big companies which never were in small formulators' market.

As example, not limitant, we can imagine an industry which makes coatings, resins for composites, elastomeric matrixes, adhesives or so forth. During 2010 these industries had the following types of problems:

- Lack of monomers with suppliers totally closed for months (as the case of epoxy prepolymers). Today it is not totally restored but some prices were multiplied by a factor 2.
- Lack of a great numbers of amines used as curing agents in epoxy compositions. The situation in some cases is still critical, and the price is strongly increased.
- Lack of several acrylic monomers. The market of MMA, acrylic acid,2-ethylhexylacrylate is still under problems and some prices were increased by a factor 2.2-2.5.
- Lack of emulsions to make water born based coatings.

The list of products would tend to an indescridable figures. The lack of additives of all kinds, vital in formulations like pigments, thixotropic agents, diluents, solvents, and surfactants play also a very important role in this situation. As consequence many companies were closed and other are under a complicate situation.

In our particular case, the company that I am representing could handle these adverse circumstances attending to the required properties of a product more than a chemical family. If there are not raw materials to make, for example, an ambient cure epoxy adhesive, we need to seek an alternative in other family of polymers attending to parameters like:

- PRE-CURE:
  - Surface energy
  - Viscosity
  - Density
  - Thixotropy
- CURE:
  - Gel time (isothermal and adiabatic conditions)
  - Heat of reaction
  - Exothermic peak
  - Glass transition temperature (Tg^c and Tg^∞)
  - Conversion *vs* temperature and time (TTT diagram)
  - Residual monomers (when necessary for applications where the product has in contact with food or drinks).
- POST-CURE:
  - Mechanical properties at one or more temperatures (tensile, compression, flexure, fracture energy).
  - Adhesion test (lap shear, tensile adhesion, peel).
  - Aging test (properties before and after water uptake at different temperatures).

All these measurements can provide us enough information to look for alternatives on other family of polymers. For instance MMA or PU if the market availability recommend it.

For it, one needs a well-equipped laboratory with specialized personnel to carry out the necessary R&D. These facts were particularly useful during 2010 (we are still alive!!) and probably it will be the only future.

As illustrative example a historic case will be described. It is the development and study of a MMA adhesive requested by a wind blade company in competition with two very big productors specialized in this type of adhesives. For this purpose several studies of pre-cure, cure and post-cure were carried out. The use of different analytical techniques such as differential scanning calorimetry (DSC), infrared spectroscopy (FTIR), dinamomechanical analysis (DMA), thermogravimetric analysis (TGA), rheometer, mechanical tester and so forth (all of them in our laboratory) were necessary.

Finally a nanostructured MMA adhesive was obtained with excellent balance of properties which allows us to be in a very good position with respect to the other competitive companies, which were already

practically discarded.

We believe that the fact of that the 40% of all the personnel of our company are involved in our R&D department is the best guaranty of future.