

Challenge - Industry 4.0

Standard Profil



SENSOR TO MEASURE THE DEGREE OF VULCANIZATION

DESCRIPTION

In the manufacture of rubber profiles by coextrusion, one of the most important processes is the vulcanization of the rubber, a process in which the material passes from a plastic to an elastic state as a consequence of the cross-linking of the molecules of the elastomer. This vulcanization process is based on two fundamental parameters: the temperature and the processing time at that temperature.

The main characteristics of the rubber profile obtained in these processes depends to a great extent on the degree of vulcanization obtained in the process, for instance the permanent deformation is highly dependent on the degree of vulcanization and this permanent deformation determines the way in which the profile will behave under load and the recovery of its shape after the elimination of this load.

Other important point to consider is the durability of the parts manufactured with these rubber profiles which depend to a large extent on these final characteristics of the profile, so that guaranteeing the correct vulcanization of the rubber is fundamental.

Unfortunately the methods for measuring the degree of vulcanization are not applicable continuously, much less in real time, so that control tests have to be performed in the laboratory, with the consequent lack of real-time information on the evolution of the degree of vulcanization of the rubber.

The present challenge involves the development of a system or technology for the direct measurement or indirect calculation of the degree of vulcanization of the rubber that composes an extruded profile during the extrusion process in a continuous and real-time manner.

One of the lines of work considered is the search for other physical characteristics of the rubber profile obtained, which are correlated with the degree of vulcanization and can be measured continuously, so that a real-time estimation of the degree of vulcanization value can be made indirectly.

Considering the conditions of the extrusion process, where the profile moves along the line at speeds between 12 meters / minute and 28 meters / minute, any measurement method must take into account this situation, considering the most viable of those that perform the measurement of the variables / features without contact.

GOALS

- Determination of variables of the final product (profile) that correlate with the degree of vulcanization

Determination of all the variables or characteristics of the extruded profile that correlate with the degree of vulcanization of the rubber. It is necessary to consider that the profiles are composed of the coextrusion of several rubbers and that the variables or characteristics to be measured in real time and in continuous will be for one or several of these rubbers that make up the profile.

Other aspects to consider are:

The profile is inscribed in a rectangle approximately 25X50 mm.

Any measurement that has to be made will be done on the profile at the extrusion speed (between 12 and 28 meters / minute). Only in the case of some profile types, the profile remains stopped for 2 seconds in the cutting process.

- System calibration

Once the variable / characteristic of the profile that correlates with the degree of vulcanization has been defined, the calibration procedure must be established to perform the estimation of the degree of vulcanization as a function of the measured variable.

- Specification / Development of the measurement system

In the same way as in the previous goal, once the variable that correlates with the degree of vulcanization is determined, the specifications of the system for measuring said variable must be defined continuously and in real time on the profile. If possible, it would be necessary to carry out the preliminary design for the fabrication of a functional prototype.