

STUDY ABOUT THE DEGRADATION'S RESTRICTION OF THE CYLINDERS

FLORESCU IULIAN, FLORESCU DANIELA

Bacau University

Abstract: *Some machine's rollers are covered with materials which are usually damaged because of their contacts with different chemical substances during the technological process. Present paper presents the factors which contribute at the degradation of the rollers and the experimental tests which point the standard of the degradation.*

Keywords: roller, erroded surface,

1. THEORETICAL CONSIDERATION

Same machine's cylinders are covered with materials with polymers (elastomers or plastomers). The elastomers contain natural rubber and different varieties of syntetic rubber (chloroprene, nitrile, polyurethanes etc.). The only plastic polimers used-up like an outer covering of the cylinder are epoxi-type.

The composition of the elastomers and the plastic materials has a good resistance to the low acids, the alcaline produces and the solutions of the salts used in paper (stationary) industry. However it is possible to be problems to alkaline process whwre the pH is between 8 and 9.

The changes which are produced when the water is treated can affect the composition of the materials. Other important difficults appear when there are solvents (aliphatic like naphta and aromatization like benzene) in the system. All these produces are used-up like for resin's dispersion, can be added subsequently for feld's levigation. They can attack and penetrate the roller's outer covering. Usualy a chemical attack induces the rubber's ageing and his degradation, of course.

However, sometimes, the plastifiers are extract of elastomers which induces hardening. Ocasional association with different chemical produces can determinate the degradation and plasticity's loss (but the hardness are unchanged). Because the change of volume or hardness there are in that materials, the resistance to rupture and to disrupting is eliminated. For cylinders, all tese changes are manifested throught chippings and/or fissures around the absorbing holes, the bursting to the surface for the fluted pressure rollers and the cups for the compact rollers.

Another product which contributes to degradation is water. All the elastomeric outer covering, especially the polyurethanes, absorb the water. Diffusionlevel is accelerated by mechanic pressure, speed and vlome's variations. The water also can produce the change of hardness, the variations of the volume, and the reduction of the plane appearange and undercoatings degradation till metal's level.

Practicaly, the action of the chemical produce or of the chemical mixture concerning the elastomer-composition is established throught laboratory test "plunge test". The same tests follow very definite procedure for every test.

The ASTM plunge test is used like guide: the test specimen of the outer covering's material is dipped in a chemical solution for a certain period; then the physical features changes are measured. For accurate informations it is necessary to planificate and control very exactly the test's conditions. For the acceleration of the test, the concentration and the temperature can be incrementated.

2. EXPERIMENTAL RESULTS OF CONCERNING THE ROLLERS OUTER COVERING

The most tests present the modifications of the hardness, weight and volume, using the resistance to rupture, elongation and resistance to disrupt. The dimension and the variation of the materials future must be appreciated.

So, the hydrocarbon with low molecular weight and low viscosity (like benzene) touch their maximum intumescence level very quickly (one – two days) and a short test-period is enough.

The solvents with high molecular weight and high viscosity will make intumescence very slowly (more months).

It is necessary a period of smallest 30 days to estimation same materials. If pressure rollers outer covering is exposed of chemical agent's attack, then its composition will be affect having different apparences:

- The penetrability and the intumescence of the composition by chemical agent therefore the ageing and the loss of the physical feature. In the special cases, the outer covering became very sensitive and crumbles it self very easy. The most hydrocarbon solvents challenge this chemical attack-type;
- The penetrability or the extraction of one or more dissolable elements of the mixture. Usually, this action has like consequence the mixture's bracing, the surface becaming fragile and fractured;
- It is possible to be a chemical reaction between the produce which attacks and bases elastomer. This kind of reaction begins with a surface attack and it can vary from the sticky surface condition to fractures and pulling out of the surface.

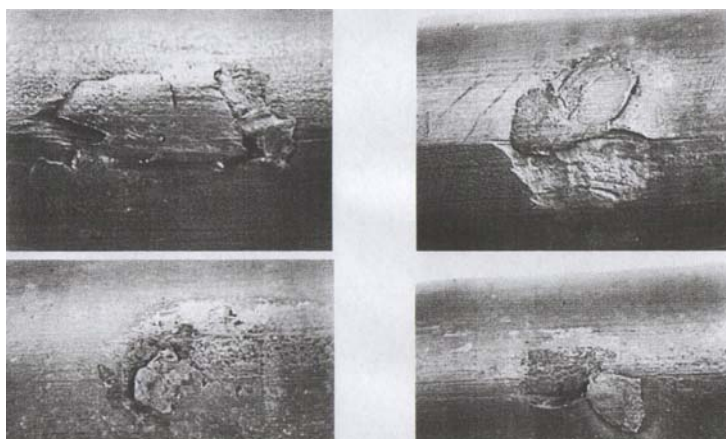


Fig. 1.

These three chemical attacks-type are presented throught a simple plunge- test of the specimen (figure 1). The left specimen presents an excessive intumescence and ageing induced, by the aliphatic solvents with low molecular weight and low viscosity. The following two tests –specimens illustrate the reaction between chemical solution and the elastomer-composition. The right test is a resisting oil composition which resisted well to all conditions which induces excessive intumescence of the first test-specimen.

This type of empirical estimation of the outer covering is necessary when the unknown chemical produses actuale. At present for plunge test's interpretation and for the preliminary selections it is well to understood the chemical mechanism which are associated with the intumescence of the elastomers and plastic materials.

A great number of plunge test show that the intumescence and hardness' modification of the elastomer component part follow reaction level well established (physical and chemical). Attack's force of the chemical produce depends by its concentration in solutions, by temperature, by contact-time or plunge time.

If chemical produce's concentration increases, attack's force to outer covering increases, too. Increasing plunge-time or exposure-time, the intumescence and the ageing increases, too, but not proportional. The high temperature accelerates always attack's speed in accordance with "rule by 10" degradation standard double it self for every growth by approaching 10°Celsius of the temperature. The temperature is a practical factor very important.

Figure 2 presents the relation between concentration and hardness (it is the real results conclusion of the plunge-test). Figure 3 compares intumescence standard of two different elastomers the same solvent (detergent for felts' levigation).

One of them is the outer covering standard from figure 2 and other is a specila felt which is resistant to oil and which shows when is necessary a specila resistance. The results show that a very strong solvent's attack can't be stoped (diminishing the it's concentration temperature or introducing a outer covering with a greater resistance), but it can be diminished.

It is possible to anticipate these attacks throught frequently controls of the rollers and the outer covering's an ajustement before the attack becomes dangerous.

Therefore, the concentration's diminishing of the produces which attack especially the polimers slow down the attack process but it doesn't stop it completely even the its concentration is smallest. This phenomom is a very important fact, mentioned shorty in scientific papers and generally it isn't studied enough by the specialists. This phenomenon is known as "selective absorbing phenomenon".

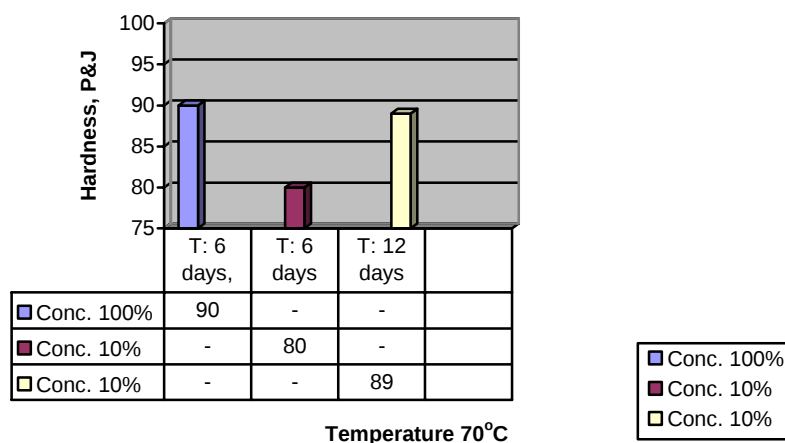


Fig. 2. Relation between the concentrations and hardness like a results of the conclusion give by the results of the immersion tests

During the test in these solutions an amount of chemical produce is added continously for changing the absorbed amount by elastomers. Applying this draft of "selective absorbing" of the liquid which comes in contact with outer covering (circulation water or felts'), small amounts of chemical produces (especially detergents and resin), will be absorbed constantly by rollers'surface. If a mechanic load acts on the roller's surface, a fine shet of the outer covering can be pulled out. The mechanic load can be a rabbler, a knife bar or the levigation nozzle. It is possible the erosion be induced by hydraulic forces of the levigation nozzle.

In paper industry, the outer covering can be eroded by combined action of the chemical attack and of the mechanic force in the same time. The configuration of the eroded surface depends by regularity and simultaneity of the chemical attack and the mechanic action.

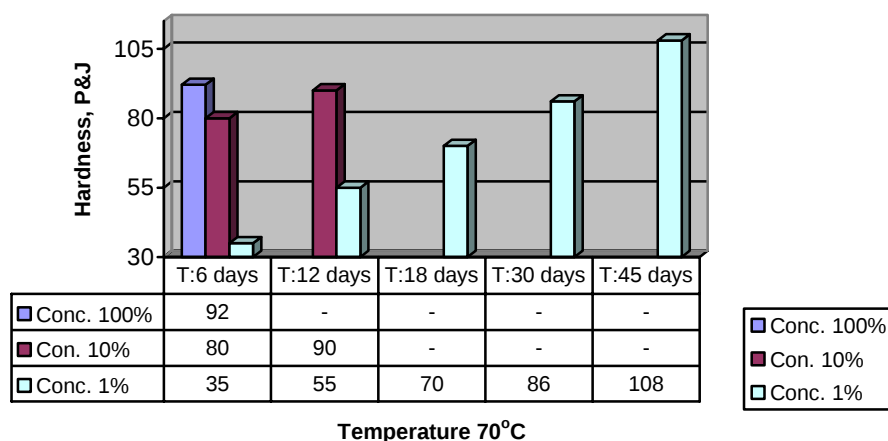


Fig. 3. The intumescences standards collate of two different plasters which are in same solvent

The erosion of the roller's outer covering represents an important problem for the paper industry. Figure 4 presents a great eroded surface on a pressure roller (a coating of 2,5 mm was fractured). There are many other analogous zones in the other part of the cylinder. On the figure 5 we can observe a extreme part, of the other cylinder which functiones on the same machine. The glossy part which was soft and sticky corresponds with breadth of the paper sheet. It is the results of the chemical produce's absorbing and of the chemical mixture included in the paper sheet. This fact degradated the surface completly. A little zone in the middle of the paper sheet was degraded by a mechanic force. The detailed chemical analysis points the wood resis's presence on the pressure roller's surface. The most important quantities werw found in a glossy zone and the smallest in a matte zone and a complet absence in the outer covering's interior.

3. CONCLUSIONS

The different appear ances mentioned previously underline the necessity of the colaboration between the persons who utilize these equipments and the specialists of the rubber industry for obtaining a maximum life for outer covering.

The all problems can be eliminated throught a correct selection of the elastomers of the composition. We must be careful with the upkeep procedure. Operating personnnel must be careful with the following problems:

- to control frequently the surface of the outer covering for detecting the smallest degradation, correcting the cause and saving the outer covering throught adjustment;
- the procedure of the rollers must test the new chemical produces utilized for the levigation of the felts, before utilization;
- the levogation produces for felts and the chemical additive must be secured only from famous firm which have the best laboratory;
- it isn't allowed the growth of the concentration, of the temperature or of the levigation period prescribed by the producer of the chemical produces;
- it is very well to avoid (if it is possible) a levigation substances which contain organic solvents). The acid, the detergents or alkaline detergents are prefered;
- if the levigation are made with solvents, the levigations will have a continous system;
- a carefully examination of the auxiliary equipments which are in contact with outer covering.

REFERENCES

- [1] * * * La Papetteria, nr. 178/ 1994.
- [2] * * * Pulp and Paper Magazine, nr. 1, Braila, 1994.
- [3] Florescu, I., Florescu D. - *Technological equipments for Pulp and Paper Industry*, Editura Didactica si Pedagogica, Bacau, 1998.
- [4] Florescu, D., Florescu, I. – *Mechanic. Statics*. Vol. I, Editura Tehnica Info, Chisinau, 2004.