



Harry F. Bader

Causes of glove stains; fire-retardant additives; how to 'toughen' latex products

I received several medical examination gloves, all of which had dark yellow staining in a variety of areas — on a couple fingers, on the cuff, on the palm area and in several other areas. The intensity of the stains was quite even and was on both the inside and outside of the gloves. The company was well-known, and so its identity is kept confidential. Here's how I replied to a query about the causes:

The company did not want to pay for testing, so I was left with suggesting problem areas which I had experienced in the past as being the cause of similar stains and discolouration.

- The form cleaning area is a prime source of similar problems. The cleaning solution becomes contaminated with 'trash' of all sorts which can be oily and dark in colour. That 'trash' is difficult to remove once it is on the forms. It will cause the latex to discolour in those areas where that trash has collected on the forms.
- A second common source of discolouration is the leach tank. If the water flow is cut back and the nutrients in the tank start to grow, staining and discolouration will result.
- Improperly dried (wet) gloves.

Two weeks later I received an e-mail saying the problem was solved and the leach tank flow was the source.

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I have had four inquiries in the past six weeks for fire retardant additives for latex and rubber products. Some have

wanted non-halogen systems and some were not specific. Here goes my reply:

There are 33 fire retardant (FR) or flame retardant additives listed in the *Rubber World Bluebook* for 2004. Most of these are halogen systems which release chlorine or bromine. Chlorine and bromine will not support combustion and flame is suppressed.

Of the 33 additives listed, some are for specific polymers.

My personal experience with FRs is with the use of Neoprene. Neoprene foam and Neoprene gloves are obviously much more fire resistant than natural latex foam and gloves.

There are non-halogen FRs listed such as antimony oxide, alumina trihydrate, zinc borate and magnesium hydroxide. These release water vapour which acts as a barrier to prevent oxygen from reaching the flame.

I would recommend experimentation with the non-halogen additives to determine the changes in film physical properties which occur when these additives are present in a latex compound. Also at the same time, changes in flame resistance can be evaluated.

An easy way to evaluate flame resistance is to hold one end of a rectangular strip of the latex film, of standard dimensions, in a horizontal clamp and apply a Bunsen flame to the other end of the strip for 10 seconds. The sizes of the two cones in the Bunsen flame are also controlled. If the sample burns continuously after withdrawing the flame, the rate of travel of the flame along the sample is mea-

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sured. Otherwise, the time required for self-extinction of the flame is determined. This time, known as "after-flame time", and the values tabulated are the averages of six determinations.

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Please suggest a way to improve the stiffness/rigidity of latex by modifying it with some fillers or mixing it with some grafted polymers. We need the latex-dipped tubings to achieve the hardness of 60-70 Shore A as we check normally in the dry rubber products.

Segu Mohamed Ismail,
SISCO Latex Pvt. Ltd.,

This is a unique question, in that I've never had a request from a Sales Department or from a customer to increase the hardness or rigidity of a latex product. Generally, I've received complaints that the latex product was too rigid or too hard. That was particularly the case when we added fillers to reduce product cost.

However, there is much information available about both organic and inorganic additives (fillers); what they will do to a latex compound (i.e. viscosity) and what they will do to the resulting latex film (i.e. tensile strength, modulus, hardness, etc).

I recommend you obtain a copy of D.C. Blackley "Polymer Latices", 2nd Edition, Vol. 3. This includes Sec. 16.6 which provides excellent information on both inorganic and organic fillers. Source is Chapman & Hall India, R. Seshadri, 32 Second Main Road, CIT East, Madras 600 035, India.

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Can you suggest methods, other than filler loading, to increase the compression modules of NR latex mattress products, say to increase from 24 ILD to 40 ILD, keeping in mind the cost and specific gravity?

J.A.J., E42, Jipmer Qts,
Pondy-6

Although you have said "other than filler loading", a proper choice of a filler such as high styrene-butadiene copolymer could do exactly what you want.

As in the previous answer, I recommend you get a copy of Blackley "Polymer Latices", 2nd edn., Vol. 3, Sec. 16.6. This also includes Sec. 18, "Latex Foam Rubber" and covers both the Dunlop and the Talalay processes.

The data provided will give you an idea of what property improvements can be expected and also what property declines might be experienced with an additive that increases compression modulus.

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We manufacture dip items, mainly bladders. Kindly let's know if we can incorporate any filler to reduce cost (what ratio is suitable without much affecting the original properties) as tensile strength and elongation properties are very critical in our product. Tensile up to 250 kg/cm.sq. and elongation up to 850 are required.

Ashwani Magon,
Paradise Rubber Industries

This is another question about additives. But in this case a cost reduction is wanted without any great reduction in physical properties. As with the above questions regarding tubing and foam mattresses, I recommend D.C. Blackley's "Polymer Latices" 2nd Edition, Vol. 3, Sec.s 16.6 & 18.

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What is the optimum level of sulphur which will not cause 'blooming'?

Anil on e-mail

The "optimum" sulphur level is dependent on your compound and your process conditions.

Sulphur 'bloom' comes from free sulphur which is unreacted and, therefore, comes to the surface of the film as it ages.

This free sulphur occurs from one of two conditions.

- Sulphur is too much for the accelerator/zinc oxide/process cure and is, therefore, unreacted.
- Sulphur is not prepared properly to get to a 5-micron or preferably smaller particle size. Therefore, it is unreacted. ■