NASA TECH BRIEF

Lyndon B. Johnson Space Center

Fire Retardant Cellulosic Foam

The problem:

Cellulosic papier-maché structures are frequently used as ceiling tiles or wall board in the building industry. They are also used for cushioning sensitive equipment against vibration and shock. In some applications, these paper structures have to meet certain nonflammability requirements. However, when standard fire retardants are used to treat cellulosic structures, the paper becomes unnecessarily dense and friable.

The solution:

A method was developed for treating papier-maché which does not alter its density or friability.

How it's done:

The method uses a mixture of cyanamide, phosphoric acid, and monobasic ammonium phosphate for preliminary treatment of the paper. Specifically, constituents in this mixture (given in parts by weight) include the following:

1. water	28
2. concentrated phosphoric acid	20
3. monobasic ammonium phosphate	28
4. Cyanamid -50 (50% solution)	124
5. tissue	25

The first three ingredients are mixed in a shallow container. Cyanamid -50 is then mixed in and the tissue paper is added. Essentially all of the liquid is soaked up by the paper in a few minutes. The entire contents are then dried at 50° C for 24 hours then at 105° C for 15 minutes to remove the water.

After this step is completed, the second step in the process involves preparation of the papier-maché using the following ingredients in parts by weight:

1. treated paper	135
2. water	500
3. polyvinylidene chloride latex	41
4. commercially available urea formaldehyde detergent solution	200
5. commercially available urea formaldehyde resin dispersion	200

In this step, the treated paper is pulped in water in a blender, and the latex is added. Urea formaldehyde solution is then mixed in at high speed to maximize the foaming. Finally resin dispersion is added, and the mixture is then cast within 30 to 60 seconds. The end product is then dried at 50° C for 24 hours followed by another drying at 75° C for another 24 hours.

The resulting product has a density of 15.4 kg/m^3 (9.6 lb/ft^3) and is not unduly friable. It does not sustain a flame in a 100% oxygen atmosphere.

Notes:

1. The addition of hot agar just before introduction of the resin dispersion further thickens and stabilizes the foam for the drying process.
2. No further information is available. Specific questions, however, may be directed to:

   Technology Utilization Officer
   Lyndon B. Johnson Space Center
   Code JM7
   Houston, Texas 77058
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Patent status:

NASA has decided not to apply for a patent.

Source: M. Luttinger of
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Category 04