



Fig. 8. Number of bubbles larger than 0.003 in. vs. depth of etch for a few typical cover coat specimens.

the upper limit and is questionable. From a number of test specimens of this enamel, the spall resistance has been found to be erratic and questionable. Enamels B, D, and J were satisfactory from the standpoint of spall resistance as determined in the accelerated test.

Table III. Comparison of Bubble Count at 0.9 Mils and Spall Resistance

Enamel	Number of panels tested	Av. spalls/sq. ft. (25,000 cycles)	Bubbles/sq. ft. 3 mils + at 0.9 mil. etch)
H	2	0.50	345
J	22	1.00	107
D	14	1.12	72
E	8	1.50	185
B	54	1.78	110
A	14	3.69	355
C	11	4.75	580
I	2	7.50	550
F	4	4.25*	250
K	4	500-800	655

\* 10,000 cycles

### Conclusions

On the basis of this study, the following conclusions appear logical:

1. The etch method of determining bubble density shows that a definite correlation exists between the freeze-thaw spall resistance of cover coats and the number of bubbles whose apparent diameter is 0.003 in. and larger at a depth of 0.009 in. below the surface.

2. The etch method of evaluating enamel cover coats for spall resistance is sufficiently accurate to be useful both as a daily production control and laboratory test.

3. The accuracy of the method is such that the effect of mill additions, milling, ground coats, base metals, firing, etc., on spalling can be more quickly evaluated at a considerable saving in man-hours and expense than with the present test apparatus.

### Acknowledgment

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## Latest Ceramic Films

The Missouri School of Mines chapter of Keramos presents its annual up-to-date list of industrial and educational films on ceramics and related topics which are available for the use of schools and other groups.

At the end of the list of films is a list of distributors, each designated by a number. Each film is followed by a number or numbers which indicate the distributors from which the film may be obtained.

All films are black and white unless color is indicated. Most of the films are free except for transportation costs. Rental is indicated even if it applies to only one of the distributors. Whenever possible, a brief summary is included along with the title of the film.

The distributor should be consulted for details of procurement and nearest shipping point.

### Abrasives

*The Grinding Wheel, Its Care and Use*, 16 mm., 17 min., sound, color; detailed instruction in the handling, storage, and use of grinding wheels. (12)

*Grinding Wheel Markings*, 16 mm., 18 min., sound, color; clarifies a typical grinding wheel marking, explaining the meaning of each symbol. (12)

*Grinding Wheel Safety*, 16 mm., 20 min., sound, color; shows safe and unsafe practices in the handling and use of grinding wheels. (12)

*Grits That Grind—a Story of Modern Abrasives*, 16 mm., 30 min., sound, color; shows the manufacture of grinding wheels from the bauxite mines to the finished wheels. (12)

*The New Revolutionary Single Crystal Abrasive—32 Alundum*, 16 mm., 25 min., sound, color; demonstration of the inherent characteristics of the abrasive and the results achieved.

(12)  
*Precision with Norton Abrasives*, 16 mm., 15 min., sound, color; features precision instruments measuring accuracy.

(12)  
*Manufactured Abrasives*, 16 mm., 24 min., silent or sound; shows manufacture and use of abrasives. (16)

### Art and Archeology

*The Art of Keramos*, 16 mm., 26 min., sound, color; recounts the history and development of ceramic art through the centuries. (7)

*The Beginning of History*, 16 mm., 20 min., sound. (13)

*Clay in Action*, 16 mm., 12 min., sound; demonstrates sculpturing a portrait in clay. (5)

*Crafts of the Fire*, 16 mm., 10 min., sound, rental; illustrates how fire is used in making crystal-ware, stained glass windows, enamels, and in baking china, porcelain, and pottery. (1, 10)

*Line Decorating Glass and Dinnerware*. (11)

### Chemistry and Physics

*Chemistry of Combustion*, 16 mm., 11 min., sound. (13)

*The Chemistry of Fire*, 16 mm., 45 min., sound, rental; how the elements of fuel, oxygen, and ignition temperature must be present in order to have fire. (14, 15)

*The Nature of Color*, 16 mm., 10 min., sound, color. (13)

### Enamels

*Modern Porcelain Enameling*, 35 mm., 20 min., sound; processing techniques in the porcelain enameling shop. (16)

### Fuels

*The CentraHre*, 16 mm., 10 min., sound; demonstrates how the Centrafire solves fuel-burning problems regardless of grade of coal used or type of service required. (18)

*Fuel Gas Analysis*, Orsat Apparatus, 16 mm., 19 min., silent, for sale only; how to set up and use the Orsat gas analyzer. (14)

*Oil from the Earth*, 16 mm., 20 min., sound. (13)

*Radio-Frequency Heating*, 16 mm., 40 min., sound, color; a practical presentation of the principles and applications of radio-frequency heating. (18)

*Sampling and Testing of Solid Fuels*, 16 mm., 26 min., sound. (13)

*The Story of Coal*, 16 mm., 11 min., sound. (13)

### General

*From Mountain to Cement Sack*, 16 mm., 15 min., sound. (13)

*Help Yourself Beat the Heat*, 16 mm., 12 min., sound, color; an educational film on industrial heat sickness. (17)

*Measuring Temperature*, 16 mm., 11 min., sound, rental; shows how liquid and metallic thermometers work. (15)

*The Story of Rock-Wool Home Insulation*, 16 mm., 25 min., sound; shows manufacture of rock-wool and procedure for insulating a building. (16)

### Geology

*Earth's Rocky Crust*, 16 mm., 11 min., sound. (13)

### Glass

*Brazilian Quartz*, 16 mm., 10 min., sound. (13)

*Sand and Flame*, 16 mm., 21 min., sound; production of all kinds of glass. (13, 16)

*To Greater Vision*, 16 mm., 28 min., sound; the story of the manufacture of glass for use in optical instruments and eyewear. (3, 13)

### Pottery

*Colour in Clay*, 16 mm., 12 min., sound, color; portrays modern commercial pottery making in England. (5)

*Pottery Making*, 16 mm., one reel, sound. (10)

*Simple Slab Methods*, 16 mm., 10 min., sound, color, for sale only; shows three slab methods of pottery making. (9)

*Stacking and Firing*, 16 mm., 10 min., sound, color, for sale only; shows correct stacking and firing of both green and glazed pottery. (9)

*Throwing*, 16 mm., 10 min., sound, color, for sale only; shows the forming of clay pieces on a potter's wheel. (9)

### Raw Materials

*Goose Lake Fire Clay Deposits*, 16 mm., 800 ft., sound. (8)

*Missouri and Its Natural Resources*, 16 mm., 30 min., sound, color; brief shots on ceramics in state-wide descriptive film. (16)

*Nevada and Its Natural Resources*, 16 mm., 31 min., sound, color; brief shots on ceramics in state-wide descriptive film. (16)

*Ohio and Its Mineral Resources*, 16 mm., 29 min., sound, color; brief shots on ceramics in state-wide descriptive film. (16)

*Oklahoma and Its Natural Resources*, 16 mm., 26 min., sound; brief shots on ceramics in state-wide descriptive film. (16)

*Oregon and Its Natural Resources*, 16 mm., 30 min., sound, color; brief shots on ceramics in a state-wide descriptive film. (16)

*West Virginia and Its Natural Resources*, 16 mm., 32 min., sound, color; brief shots on ceramics in a state-wide descriptive film. (16)

*Wyoming and Its Natural Resources*, 16 mm., 32 min., sound, color; brief shots on ceramics in a state-wide descriptive film. (16)

### Refractories

*Master of Fire—Servant of Industry*, 16 mm., 36 min., sound, color; illustrates the various technical processes involved in the manufacture of high quality refractories. (2)

### Structural Clay Products

*For Now and Forever*, 16 mm., 29 min., sound, color; shows the manufacture of clay tile. (7)

*Making Brick for Houses*, 16 mm., one reel, sound. (10)

### White ware

*Decoration*, 16 mm., 10 min., sound, color, for sale only; shows the clay, glaze and clay slip for applying designs on a clay surface. (9)

*Glaze Application*, 16 mm., 10 min., sound, color, for sale only; shows four methods of glaze application: dipping, pouring, brushing, and spraying. (9)

*Making Dinnerware Automatically*. (11)

*The Making of Fine China*, 16 mm., 20 min., sound, color; shows the processes involved in the making of Lenox china. (14)

*Story of a Spark Plug*, 16 mm., 22 min., sound; shows the manufacture of insulators and spark plugs. (4, 16)

*The Story of the Cup*, 16 mm., 13 min., sound; illustrates every step in the manufacture of dinnerware. (7)

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