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STUDIES ON LOST-WAX PROCESS USING SILOX BINDER

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ABSTRACT

The paper highlights the reduction of shell making time without decreasing strength and permeability of shells using an accelerator.

INTRODUCTION

The casting industry is called upon to come out with products having dimensional accuracy and soundness far beyond the capabilities of foundries of yester years. Castings which are thin, complex in shape and stronger are being specified by designers, and are required in much larger quantities than ever before. These increased demands apply to all types of castings and they are being satisfied largely by the application of new materials and technology for the production of moulds and cores.

Over the several years the lost-wax process based on colloidal silica binder and various binders is being used in foundries (1). The main disadvantage of colloidal silica is that its water base makes it slow drying especially in inaccessible pockets or cores (2, 3). This gives an unpredictable production schedule. The reduction of air drying time of investment she!! moulds using so-called activated sprinkling technique causes the: fail of bending strength of shell(4). It also reduces the refractoriness of sprinkling sand.

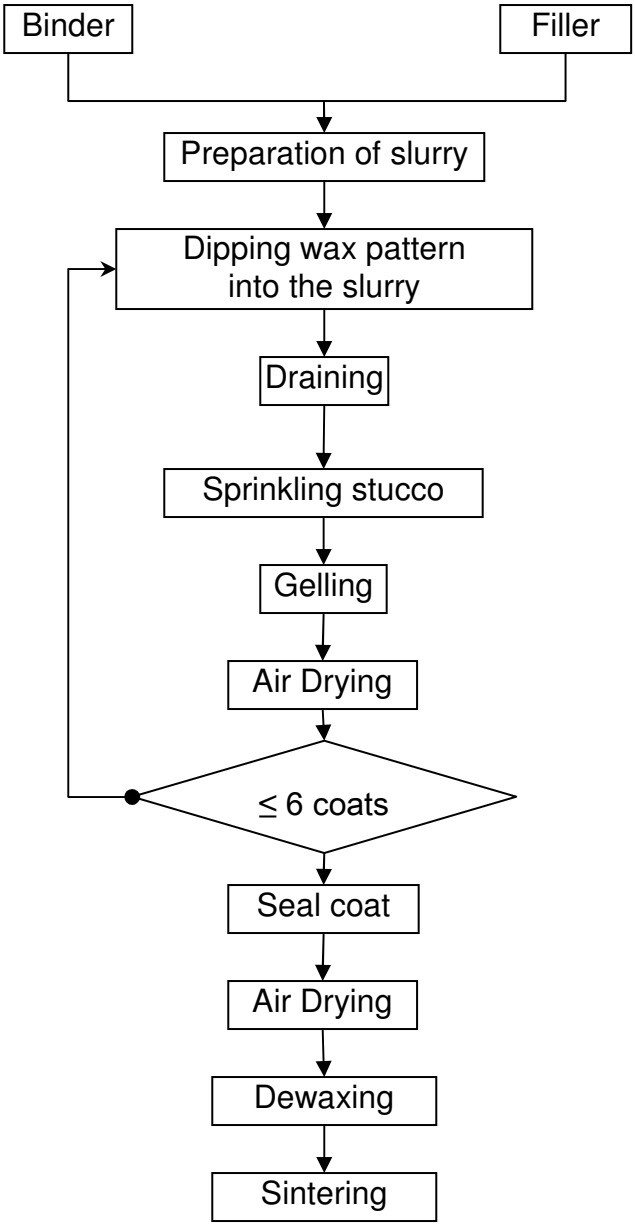

Fig. 1: Shell making process

AIM

The present investigation was to explore the possibility of using an accelerator to reduce shell making time and to improve the properties of investment shell moulds.

EXPERIMENTAL PROCEDURE

Silox is a colloidal silica binder produced by removing sodium ions from sodium silicate by ion exchange. The concentration of colloidal silica in the binder is 30 %. Slurry was prepared by adding the refractory filler (zircon powder) and accelerator (ammonium acetate) to the binder liquid, using sufficient agitation to break up agglomerates and thoroughly wet and disperse the powder, in the manufacture of investment shell moulds a multi-layered shell was built-up by repeatedly dipping a wax pattern in the slurry, draining and sprinkling with a refractory material. The grain fineness of sprinkling sand is 60. Each individual coat was hardened prior to applying the next coat. On achievement of the required thickness of the shell, the wax pattern was removed from the set-up, the investment shell mould was fired at 810°C for one hour. The various steps of the shell making process (5, 6) are shown in fig. 1.

Air drying time of each coat and accelerator content in the slurry were taken as control factors. Bending strength and permeability of the investment shell moulds were taken as variables to study the performance of shells. The test specimens were prepared with and without the addition of ammonium acetate. Six coats were given on the test specimens. Bending strength test was conducted on universal sand strength testing machine (of Versatile Equipment Pvt. Ltd). Permeability meter was employed to find the permeability of investment shells (7).

RESULTS and DISCUSSION

The variation of bending strength with air drying time of the individual coats is shown in fig.2. The bending strength of shells is found to increase with air drying time. The water removal is facilitated during the longer air drying time and hence improved shell strength. It can be seen from fig.3 that for 0.4% ammonium acetate addition the time required per unit strength developed in the shell is minimum. This is due to successful neutralization of negative charges on silicon particles of silox binder in the slurry and rapid gellation of the slurry. The efficiency of shortening air drying time of shells for the

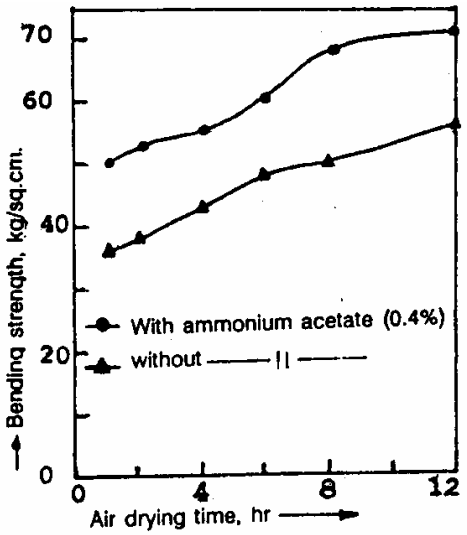

Fig.2 Effect of drying time on strength

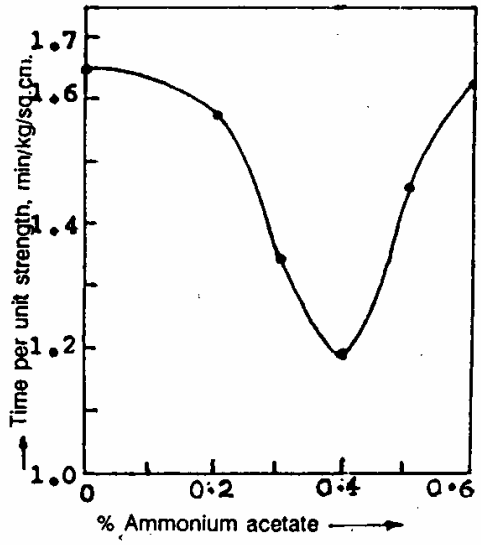

Fig.3 Effect of Ammonium acetate on drying time

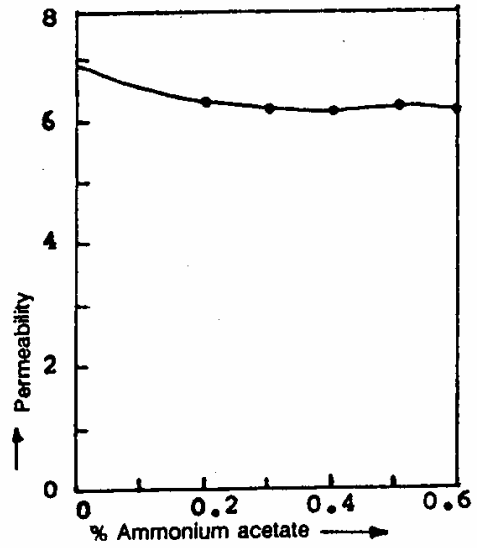

Fig .4 Effect of Ammonium acetate on permeability

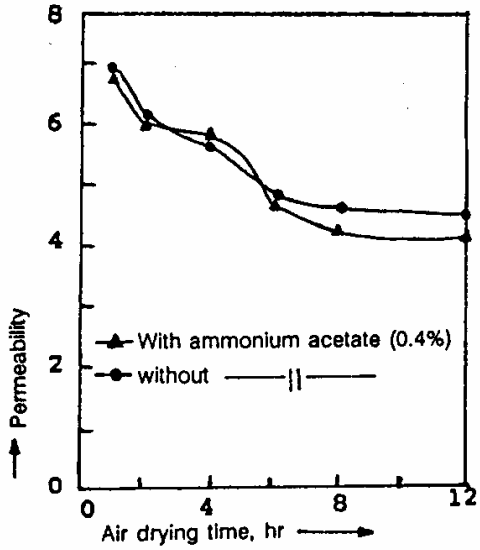

Fig.5 Effect of drying time on permeability

addition of 0.4% ammonium acetate in the slurry was 39%. The addition of ammonium acetate to the slurry does not affect the permeability of shells as shown in fig.4, but the permeability of shells is decreased with increasing air drying time between dip coats as seen from fig.5.

CONCLUSION

The addition of an accelerator, namely ammonium acetate reduces the air drying time between dip coats of shells. The maximum efficiency of shortening air drying time of shells without reducing the strength and permeability is 39%.

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