

Section 2: Ceramic Investigations

TR15-196

R.611. Study of shale content, water content and firing temperatures on dimensions of extruded pipes

Shale and clay in current use at Granton Pipe Works were supplied by J. Gilbert of Humes Ltd (Vitrified Clay Division).

The present shale content, water content and firing temperature used by the pipe works is a compromise of proportions to facilitate fabrication and limit shrinkage. By investigating a range of the variables involved, it was hoped to derive the optimum mixture which would limit shrinkage to a small range and still permit normal fabrication.

TEST WORK

Simple mixtures of clay, shale and water were made and the resultant mixtures, extruded as rods (180 mm long x 5 mm diameter) with a small hand press. The rods were then marked for shrinkage and air dried under conditions which limited distortion to a minimum. After drying, the shrinkage was measured and the rods were subsequently fired at the three temperatures shown. The firing cycle was similar in each case and the soaking time for each temperature was four hours.

RESULTS

% Shale	% Water	Total Shrinkage %			
		Dry	Fired 1,050°C	Fired 1,100°C	Fired 1,150°C
10	15.5	5.0	8.0	7.5	8.5
10	16.5	6.0	8.0	9.0	9.0
10	17.5	6.5	8.5	9.5	9.5
10	18.5	7.0	9.0	10.0	10.0
10	19.5	7.0	9.0	10.0	10.0
15	15.5	5.5	8.5	8.5	8.5
15	16.5	5.5	8.5	8.5	9.0
15	17.5	7.0	9.0	10.5	10.0
15	18.5	7.0	9.0	10.0	10.0
15	19.5	7.5	10.0	10.0	10.0
20	15.5	5.5	8.0	9.0	9.0
20	16.5	5.5	8.5	9.0	9.0
20	17.5	6.5	8.5	10.0	9.5
20	18.5	7.5	10.0	10.0	10.5
20	19.5	8.0	10.0	10.5	11.0

CONCLUSIONS

- (1) Shrinkage is related to water content and follows the classic pattern.
- (2) Shrinkage increases with firing temperature.
- (3) An increase in shale content is accompanied by an increase in shrinkage.
- (4) Slight distortion under minimum load, only occurred with samples containing 10% shale fired at 1,150°C.