

# PREDICTING FLOW FUNCTION OF BULK - SOLIDS AND POWDERS AT DIFFERENT SIZE RANGES AND MOISTURE CONDITIONS

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## INTRODUCTION

- One of the most important factors in any kind of manufacturing industry is the processing and handling of bulk-solids and powders.
- This study investigated the effects on flowability of glass beads at varying moisture levels and particle sizes.



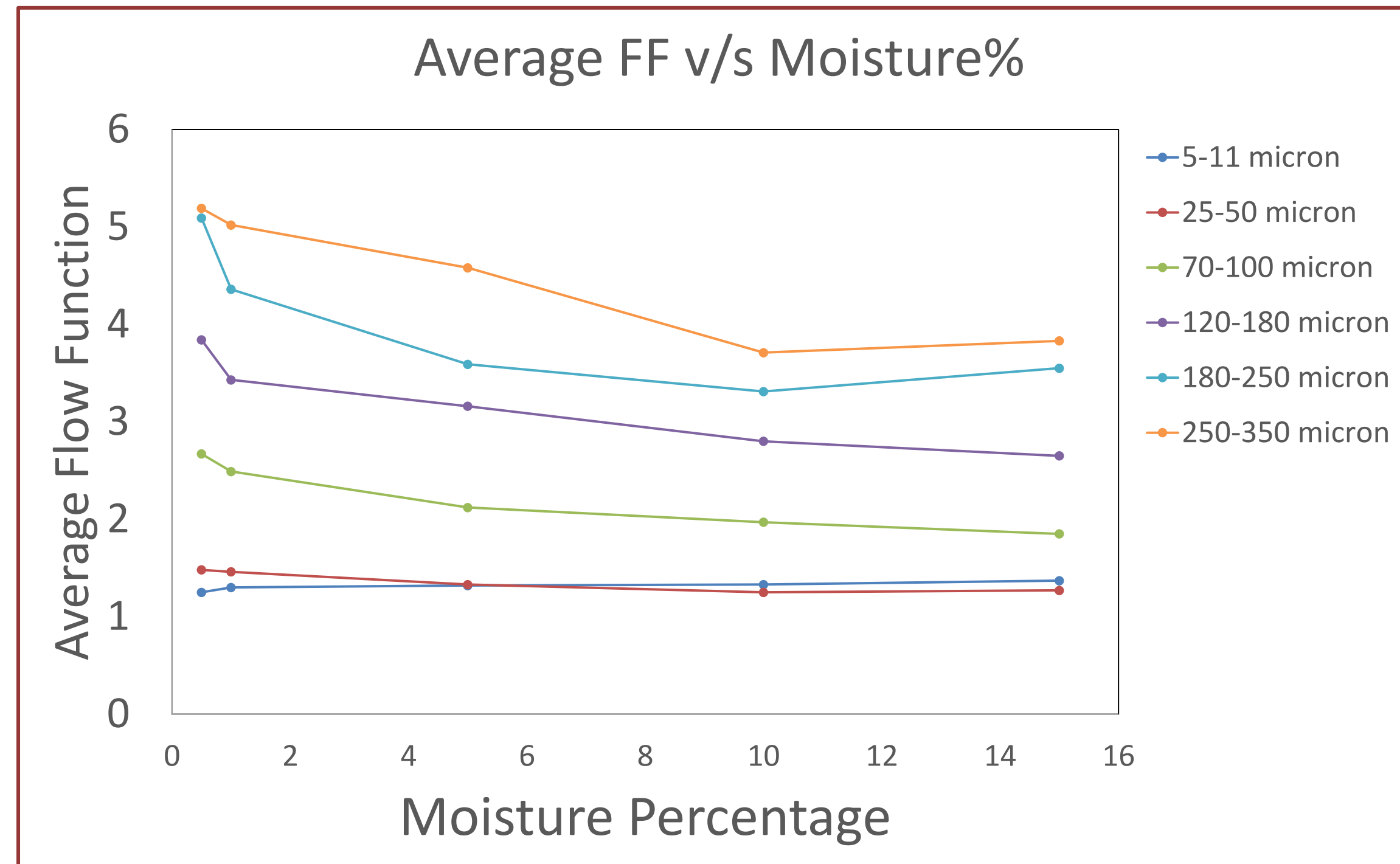
Size Ranges(microns)
5-11
25-50
70-100
120-180
180-250
250-350

Moisture %
0.5
1
5
10
15
-

$$\text{Flow Function (FF)} = \frac{\sigma_1}{\sigma_c} = \frac{\text{MPS}}{\text{UPS}}$$

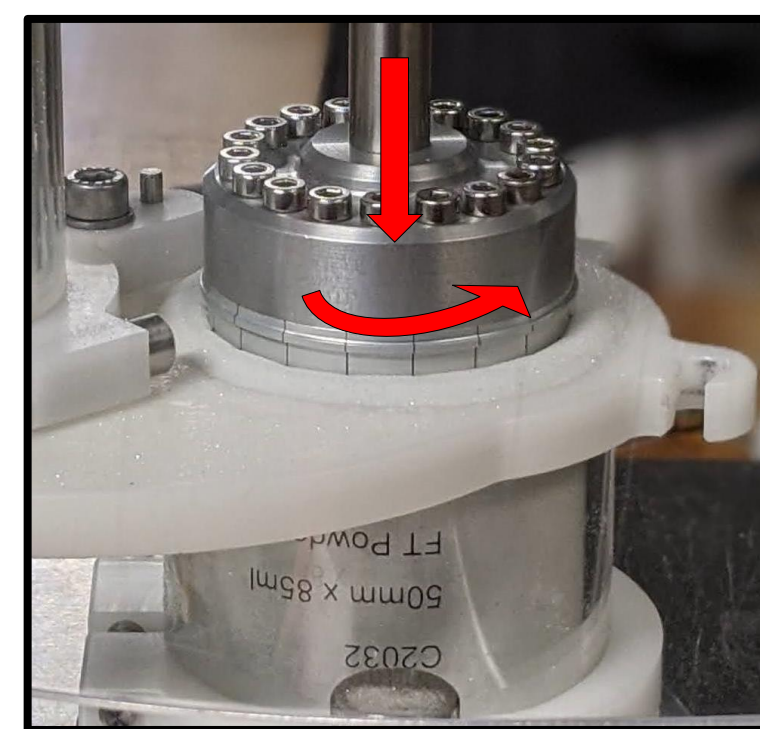
MPS = Major Principle Stress  
UPS = Unconfined Yield Strength

## PROJECT OUTCOMES



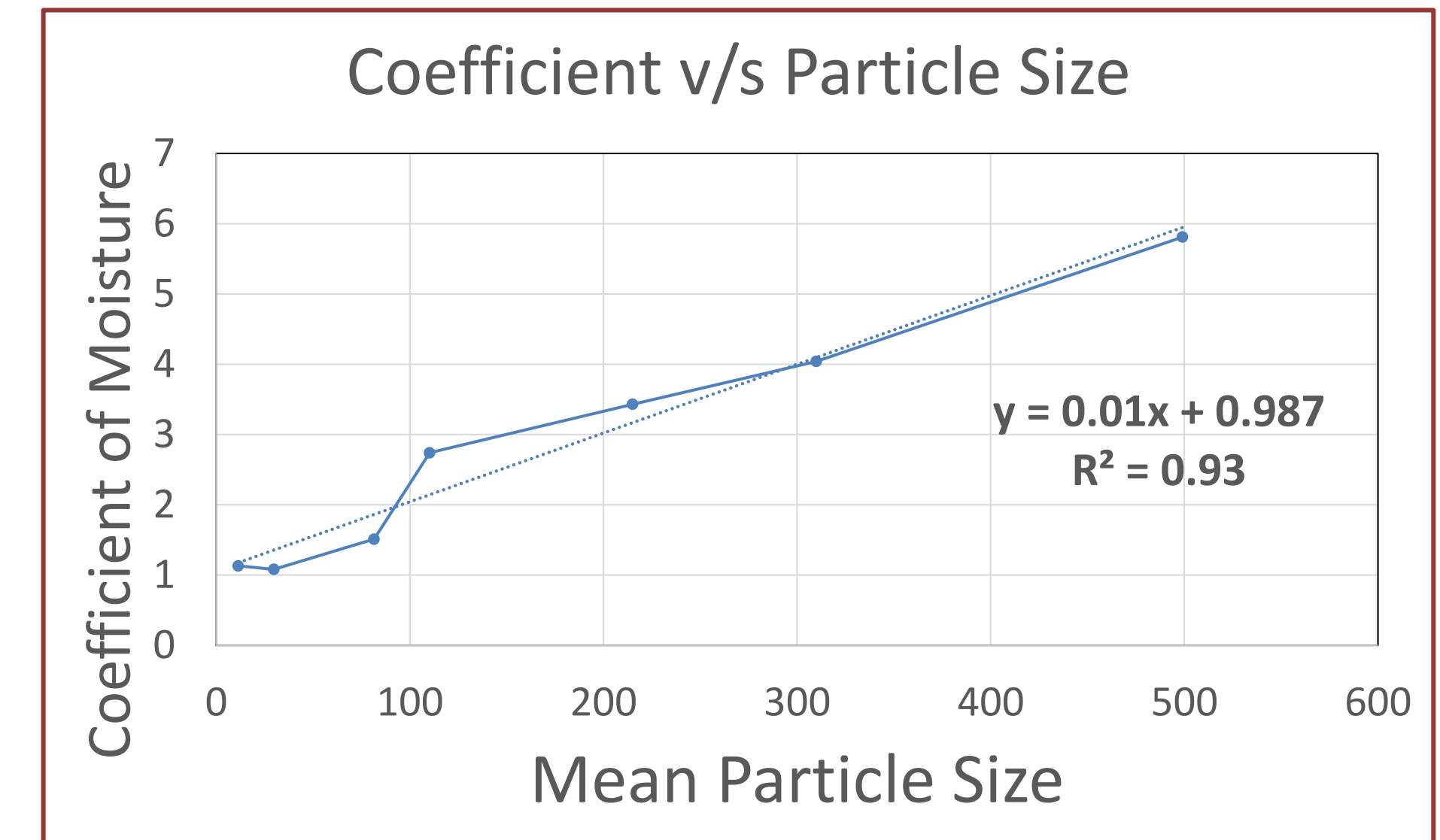
The wet glass beads were found to be following a power law and were described most closely by a power-root type equation of the following form:

$$y = ax^{\frac{1}{b}} \quad \text{Where, } y \text{ is the FF \& } x \text{ is the moisture content}$$



The Shear Cell module of the FT4 consists of a vessel containing the sample and the shear head to induce the rotational and vertical stresses.

## PROPOSED MODEL



Empirical Model:

$$FF = (0.987 + 0.01x)(1.3)^{\frac{1}{y}}$$

Where,  $x$  is the mean particle size and  $y$  is the moisture percentage

## CONCLUSIONS

- Flowability is affected by particle size, shape, moisture levels and particle size distribution.
- Future work will concentrate on the effects of particle shape and try to incorporate the same into the model.