

## APPLICATION

Chocolates have a wide range of flow properties which relate to enrobing and making blocks. In the viscosity measurement of chocolate products, it is common to describe the flow properties using the Casson flow curve, which incorporates the following two parameters:

1. Yield Value is the shear stress required to initiate flow of chocolate and relates to the coating or decorating characteristics: thickness and how quickly the coat firms up.
2. Plastic Viscosity is a function of the shear stress required to maintain constant flow. This determines how well the chocolate will flow into a mold.

To measure the Casson values, it is necessary to take laboratory viscometer readings at different speeds in order to evaluate shear stresses against different shear rates. Calculations are then carried out to determine the Plastic Viscosity and Yield Stress values which can be used to define process viscometer set points for on-line process control.

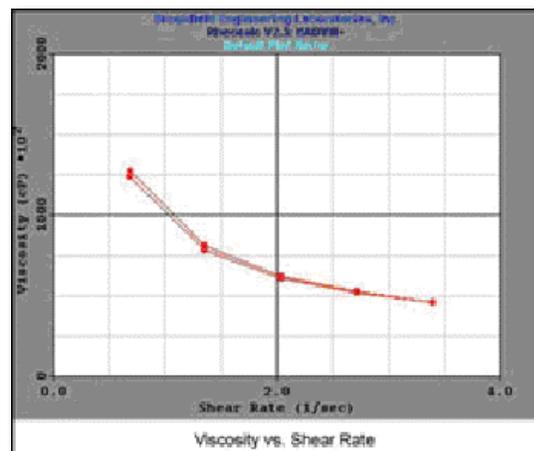
## TEST EQUIPMENT

Chocolate measurement typically utilizes the HADV-II+ PRO Viscometer and Small Sample Adapter (SSA) accessory in addition to the Brookfield TC-501 Circulating Bath. This instrument can accommodate a range of chambers and spindles; for chocolate, the recommended combination is an SC4-13R chamber with an SC4-27 spindle. When used with Brookfield's Wingather™ software for data gathering, the results can be plotted and the data further analyzed using a built-in mathematical model to calculate Casson parameters.

## TEST METHOD

Before running this test, the chocolate must be properly prepared:

- Melt the sample by heating to 50°C (122°F). Avoid overheating.
- Avoid introducing moisture and air into the sample during stirring.
- Cool sample to 40°C (104°F). Do not allow crystallization to occur.

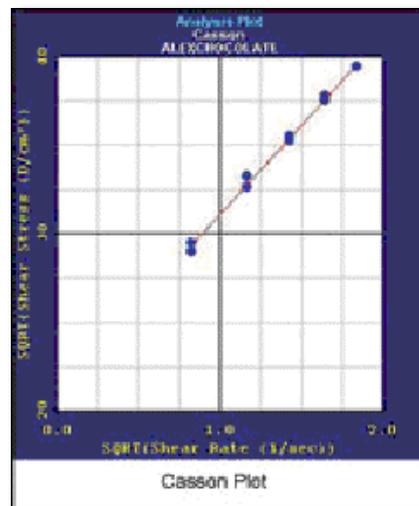




## VISCOSITY APPLICATION NOTE: CHOCOLATE PROCESSING

A sample of milk chocolate was analyzed in our laboratory to calculate a viscosity profile, as well as determining the Casson parameters of Yield Stress and Plastic Viscosity values. An up/down speed ramp was done from 2 to 10 rpm, giving a viscosity range from 127,750 to 45,750 cP, over shear rates from 0.68 to 3.40 sec<sup>-1</sup>. When the Casson model was applied to the data, the Plastic Viscosity was found to be 10,105 cP and the Yield Stress was 442.6 dynes/cm<sup>2</sup>.

*A more detailed package of information on measuring chocolate viscosity is available from Brookfield upon request.*



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