Chapter 30 should be read in conjunction with this chapter. All the information and the explanation of the figures in Chapter 30 are very appropriate to spray drying. Many comments in that chapter were pointed directly toward spray drying.

The same properties appropriate to good casting slip are also appropriate to good spray drying slip. For both kinds of slips, the body particle size distribution modulus should be $n = 0.19-0.21$. The spray dryer slip should probably have a somewhat higher MBI or its equivalent polymer or a better lubricant/binder package. The importance of avoiding dilatancy as much as possible is greater for spray drying because the atomization shear rate is so much higher than other forming processes. On the other hand it is also extremely important to use as high a solids loading as possible to minimize the energy costs in drying.

Therefore it is important that all the principles of PPC be utilized to optimize performance at a maximum solids loading to minimize energy input. Above, it was stated that the particle size distribution modulus $n$ should be about 0.20, which militates against maximizing the particle packing efficiency for maximum solids loading where $n = 0.37$. Obviously a compromise must be required.

The compromise is required by the many consequences of the particle size distribution in the spray dryer slip:

1. Spray dryer thermal efficiency.
2. Atomization efficiency and nozzle wear.
3. Particle size distribution of the spray dryer product which in turn affects:
   - Powder flowability for pressing die filling,
   - Powder segregation during flow,
   - Powder bulk density in pressing die,
   - Pressed ware density.

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Figure 32-1. Extension of a particle size to a larger $D_L$ decreases the interparticle porosity of the powder.

MAXIMIZE SOLIDS LOADING

There are two methods to increase the solids content in a suspension:

1. Adjust the particle size distribution modulus $n$ to 0.37.
   This is impossible if dilatancy is to be avoided.

2. Improve the shape of the particle size distribution.
   This can be done by either smoothing the modes in the particle size distribution or by improving the continuity of the size distribution as a straight line to $D_L$. Figure 32-1 is a schematic of the effect of extending the large end of a particle size distribution to a larger size. Since the area under the curve must equal 100%, by making the size distribution wider the volume percent of all sizes must decrease. Therefore the volume percent of each class size including $D_L$ is decreased, the porosity of the consist is decreased, the IPS at its original solids loading is increased, and therefore the viscosity is decreased. The slip can therefore be flocculated to restore its original viscosity because both dilution and flocculation shift $\mu_{\text{min}}$ to higher shear rates. Or the solids content can be increased to restore the viscosity which will shift $\mu_{\text{min}}$ slightly to lower shear rates.