Abstract

The prediction of emulsion stability is very important in the study, formulation, quality control and technical service of metal working fluids. Conventional emulsion stability methods can be very time consuming. One quick method to determine emulsion stability is to titrate an emulsion with a salt solution until the emulsion separates. The salt (or electrolyte) concentration at which an emulsion starts to separate is called the Critical Coagulation Concentration (CCC). The higher the CCC value, the more stable the emulsion. Another technique uses an instrument called a Turbiscan which collects transmission and backscattering light by scanning emulsion samples with a laser. It is a very useful instrument to monitor emulsions and dispersions in the kinetic studies of emulsion stability. The response of the Turbiscan is very sensitive to any change in emulsion or dispersion stability. It has also been utilized in the quick selection of the additives in the formulation of our bio-resistant semi-synthetic metal working fluids. These products are not susceptible to bacterial degradation, yet contain no biocides.

Introduction

Most metal working fluid products (1) are microemulsions (clear) in their concentrate form. When these products are diluted at customer sites, they form either emulsions or microemulsions for application in various metal working operations. One of the most common problems encountered at customer sites is the emulsion stability. When an emulsion deteriorates, it can cause many problems such as decreased tool life, corrosion and rust, foam, odors and scum. It is very important to keep metal working fluids stable since they have a direct impact on customer’s productivity.

Microemulsions are known to be thermodynamically stable systems. Once a microemulsion is formed, it can theoretically be stable forever. However, emulsions are not stable systems and they eventually will break down. The separation of the oil and water phases of an emulsion is a kinetic process. Usually when we say an emulsion is stable, it actually means the emulsion takes a long time to separate. Emulsion stability in a customer application is affected by many factors such as water hardness, pH, bacteria, ionic strength, temperature and contamination. In order to improve emulsion stability we must first understand the mechanisms of stabilizing an emulsion. Generally there are two mechanisms to achieve emulsion stability (2). These are shown in Figure 1.