C_{12}) unsaturated fatty portions. Metathesis chemistry provides an opportunity to generate precursors having shorter chains and mostly *trans-* isomers, which could impart improved performance when the precursors are converted to downstream compositions (e.g., in surfactants).

Sulfation of alcohols produces alcohol sulfates, which have an C-O-SO_3X group, where X is typically an alkali metal or ammonium ion from a subsequent neutralization step. Sulfonation of unsaturated hydrocarbons gives sulfonates, which have a C-SO_3X group. When an unsaturated alcohol is the starting material, the unsaturated sulfate can be produced under some conditions (see, e.g., WO91/13057). With other reagents, alcohol sulfation and carbon-carbon double bond sulfonation may compete, with most of the reaction product resulting from sulfation, although the nature of the sulfonated by-products is generally not well understood (see, e.g., U.S. Pat. No. 5,446,188). Because of the competing side reactions, unsaturated alcohols are usually avoided when the goal is to make an alcohol sulfate or ether sulfate.

SUMMARY OF THE INVENTION

The ~~invention~~ present disclosure relates to sulfate and sulfonate derivatives made by one or more of alkoxylating, sulfating, sulfonating, and sulfitating monounsaturated fatty alcohol compositions. In one aspect, the invention relates to a sulfate and sulfonate derivative made by one or more of alkoxylating, sulfating, sulfonating, and sulfitating a monounsaturated fatty alcohol composition, wherein the fatty alcohol compositions are obtained by reducing a metathesis-derived monounsaturated alkyl ester. Of particular interest are the sulfate and ether sulfate derivatives. Microscopy studies indicate that the unsaturated sodium sulfates in particular have a lamellar phase that should enable formulation at high actives levels. In another aspect, the invention relates to a fatty alcohol ethoxylate sulfate as disclosed herein. In another aspect, the invention relates to a mixture comprising water and from 1 to 80 wt.%, based on the amount of mixture, of the derivative as disclosed above. In another aspect, the invention relates to a liquid surfactant composition comprising the derivative as disclosed above, wherein the surfactant can be processed, formulated, or both at a higher actives level compared with that of a similar composition comprising a

saturated analog of the derivative. In another aspect, the invention relates to a process which comprises reducing a metathesis-derived monounsaturated alkyl ester to produce a monounsaturated fatty alcohol composition, and making a sulfate or sulfonate derivative by one or more of alkoxylating, sulfating, sulfonating, and sulfitating the monounsaturated fatty alcohol composition.

In another aspect, the invention relates to sulfate compositions comprising 40 to 60 wt.% of a monounsaturated fatty primary alcohol sulfate and 40 to 60 wt.% of a secondary hydroxyalkyl fatty primary alcohol sulfate. In another aspect, the invention relates to a mixture comprising water and from 1 to 80 wt.%, based on the amount of mixture, of the composition as disclosed above.

In another aspect, the invention relates to a composition comprising a monounsaturated fatty alcohol alkali metal sulfate having at least one lamellar phase at an actives level within the range of 65-80% actives.

In another aspect, the invention relates to a process for making an internally monounsaturated fatty alcohol sulfate, the process comprising reacting a terminally monounsaturated fatty alcohol with sulfur trioxide in a falling-film reactor, followed by neutralization.

The derivatives and sulfate compositions are valuable for many end-use applications, including, for example, agricultural dispersants, water-soluble herbicides, anionic emulsifiers for agricultural use, hard surface cleaners, light-duty liquid detergents, personal cleansers, gas well foamers for oilfield applications, laundry detergents, enhanced oil recovery compositions, latex paints, and specialty foams.

In aspects, there is provided a dispersant for agricultural compositions comprising the derivative or ethoxylate sulfate or sulfate composition as disclosed above.

In aspects, there is provided a water-soluble herbicide composition comprising the derivative or ethoxylate sulfate or sulfate composition as disclosed above.

In aspects, there is provided an anionic emulsifier for agricultural compositions comprising the derivative or ethoxylate sulfate or sulfate composition as disclosed above.

In aspects, there is provided an aqueous hard-surface cleaner comprising the derivative or ethoxylate sulfate or sulfate composition as disclosed above.

In aspects, there is provided a personal cleanser comprising the derivative or ethoxylate sulfate or sulfate composition as disclosed above.

In aspects, there is provided a foamer, foam additive, or dispersant for use in gypsum, concrete, or fire-fighting applications comprising the derivative or ethoxylate sulfate or sulfate composition as disclosed above.

In aspects, there is provided a gas well foamer for use in oilfield applications comprising the derivative or ethoxylate sulfate or sulfate composition as disclosed above.

In aspects, there is provided a light-duty liquid detergent comprising the derivative or ethoxylate sulfate or sulfate composition as disclosed above, wherein the fatty alcohol composition is made by reducing a metathesis-derived C_{14}-C_{17} monounsaturated lower alkyl ester.

In aspects, there is provided a laundry detergent comprising the derivative or ethoxylate sulfate or sulfate composition as disclosed above.

In aspects, there is provided a surfactant composition for use in enhanced oil recovery, comprising the derivative or ethoxylate sulfate or sulfate composition as disclosed above.

In aspects, there is provided a surfactant composition for use in emulsion polymerization, comprising the derivative or ethoxylate sulfate or sulfate composition as disclosed above.