cure step after application. However, alkyd and urethane coatings produced using solvent-based polymer systems have a tendency to be non-uniform and uneven after drying (air-cure), have low oil-contact angles, and poor cleanability ratings. Attempts have been made to overcome the problem of lack of evenness/uniformity, and to increase the cleanability and oil- and water-repellency of these types of coatings by the addition of a variety of surfactants and other compounds.

The present invention addresses the issues described above by introducing compositions comprised of solvent-based fluoroalkyl (meth)acrylate copolymers with short perfluoroalkyl groups of 6 or less carbons. They are utilized as coating additives and impart unexpectedly desirable surface effects such as: uniform spreading, increased water and oil contact angles, enhanced cleanability to the coated film and air-cured coated surface.

SUMMARY ~~OF THE INVENTION~~

The present invention provides a fluoropolymer composition that is useful as a coating additive comprising a fluoropolymer and an organic solvent, wherein the fluoropolymer comprises repeating units in any sequence of the following:

I: $[R_f—X—Y—C(O)—CZ—CH_2]_a—$

II: $[R_f—X—Y—C(O)—CH—CH_2]_b—$

III: $[R^1—O—C(O)—C(CH_3)—CH_2]_c—$

IV: $[R^1—O—C(O)—CH—CH_2]_d—$

V: $[R^2—O—C(O)—CH—CH_2]_e—$

VI: $[R^2—O—C(O)—C(CH_3)—CH_2]_g—$

VII: $[R^3—Y—C(O)—CT—CH_2]_h—$

wherein

each R^4 is independently H, CH_2OH or C_jH_{2j+1};

i is 1 to about 200; and

j is 0 to about 40;

provided that

1) the repeating unit I, $[R_f—X—Y—C(O)—CZ—CH_2]_a—$, is present at a minimum of about 25% by weight of the polymer;

2) repeating units I and II ($[R_f—X—Y—C(O)—CZ—CH_2]_a$ and $[R_f—X—Y—C(O)—CH\text{-}CH_2]_b$) are present at a minimum combined total of about 30% by weight of the polymer; and

3) the total of all repeating units, I – VII plus any optional monomers equals 100% by weight of the polymer.

The invention further provides a coating composition comprising the fluoropolymer composition and a method for treating a substrate comprising contacting the substrate with the coating composition.

In one aspect, there is provided a method for treating a substrate with a coating composition comprising contacting the substrate with the coating composition as defined above and drying or curing the coating composition on the substrate.

In another aspect, there is provided a coated substrate wherein the substrate comprises a dried coating produced from the coating composition as defined above.

DETAILED DESCRIPTION

All trademarks are denoted herein by capitalization. In all instances herein, the term "(meth)acrylate" is used to denote either or both acrylate or methacrylate.

The present invention provides a fluoropolymer composition comprising a fluoropolymer and a solvent wherein the fluoropolymer is a fluoroalkyl (meth)acrylate copolymer. The fluoropolymer comprises repeating units I – VII as set forth herein, in any sequence. The fluoropolymer may be a random copolymer, statistical copolymer, block copolymer, multiblock copolymer, gradient copolymer, or alternating copolymer. The fluoropolymer comprises repeating units in any sequence of the following:

I: $[R_f—X—Y—C(O)—CZ—CH_2]_a—$

II: $[R_f—X—Y—C(O)—CH—CH_2]_b—$