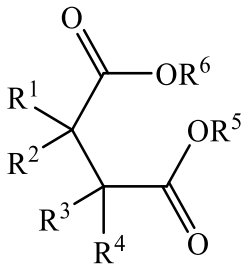
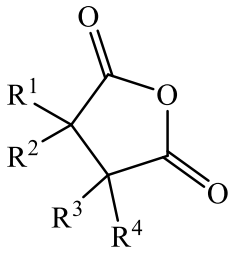
CLAIMS

1. A method for improving the ability of a lubricating oil contaminated with water and fuel to reduce corrosion in a hybrid engine, said method comprising lubricating and operating the engine with an internal combustion engine lubricating oil composition comprising:
    a. a major amount of an oil of lubricating viscosity;
    b. one or more compounds containing a carboxylic-acid functional group, ester functional group, or anhydride functional group represented by formula (I) or (II),



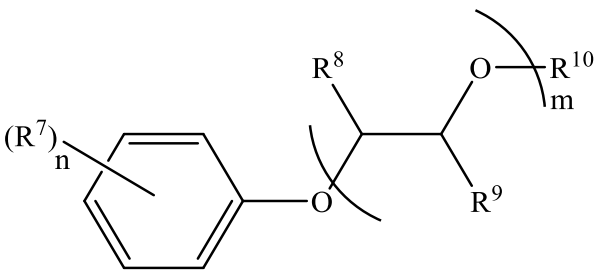
(I)



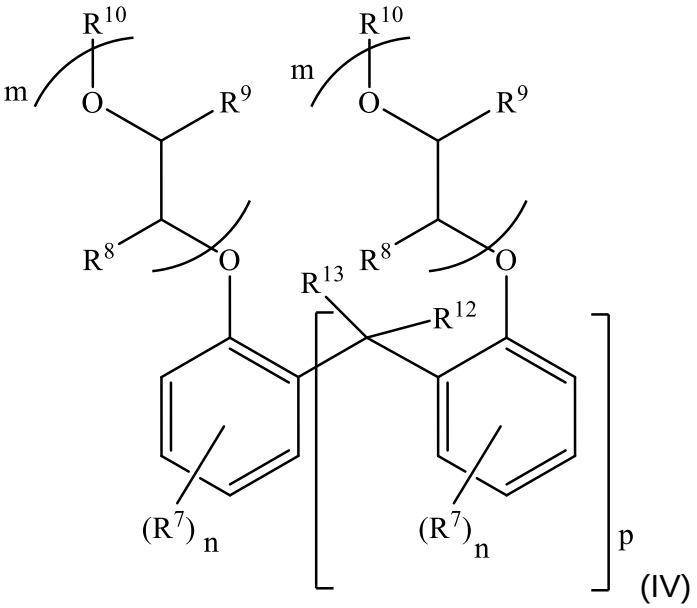
(II),

where each R^1, R^2, R^3, and R^4 is independently a hydrogen radical, hydrocarbyl radical, or hydrocarbylene radical, each R^5 and R^6 is independently a hydrogen radical, hydrocarbyl radical, or hydrocarbylene radical, where at least one of R^1, R^2, R^3, and R^4 is a hydrocarbyl or hydrocarbylene radical; and

    c. a polyalkoxylated hydrocarbyl phenol represented by formula (III) or (IV):



(III)



(IV)

where each R^7 is independently a hydrocarbyl or hydrocarbylene radical of 1 to 250 carbon atoms, each R^8 and R^9 is independently a hydrogen radical, hydrocarbyl radical of 1 to 6 carbon atoms, or hydrocarbylene radical of 1 to 6 carbon atoms; R^{10} is a hydrogen radical, hydrocarbyl radical of 1 to 24 carbon atoms, hydrocarbylene radical of 1 to 24 carbon atoms, or acyl radical represented by —C(═O)R^{11}, R^{11} is a hydrocarbyl or hydrocarbylene radical of 1 to 24 carbon atoms, R^{12} and R^{13} are independently a hydrogen radical, hydrocarbyl radical of 1 to 24 carbon atoms, or hydrocarbylene radical of 1 to 24 carbon atoms, n is 1 to 3, m is 1 to 50, and p is 1 to 50.

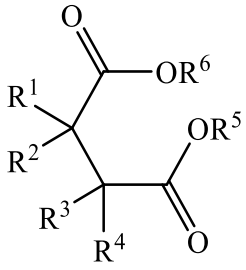
2. The method of claim 1, wherein the one or more compounds containing a carboxylic-acid functional group, ester functional group, or anhydride functional group is present in an amount ranging from 0.05 to 3.0 wt% based on total weight of the lubricating oil composition.

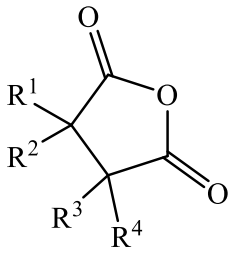
3. The method of claim 1, wherein the polyalkoxylated hydrocarbyl phenol is present in an amount ranging from 0.05 to 3.0 wt% based on total weight of the lubricating oil composition.

4. The method of claim 1, wherein the lubricating oil further comprises antioxidant, anti-wear agent, detergent, rust inhibitor, dehazing agent,

demulsifying agent, metal deactivating agent, friction modifier, pour point depressant, antifoaming agent, co-solvent, corrosion-inhibitor, dispersant, multifunctional agent, dye, or extreme pressure agent.

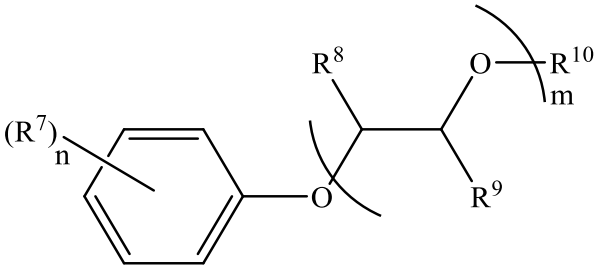
5. The use of a lubricating oil composition comprising:
    a. a major amount of an oil of lubricating viscosity;
    b. one or more compounds containing a carboxylic-acid functional group, ester functional group, or anhydride functional group represented by formula (I) or (II),

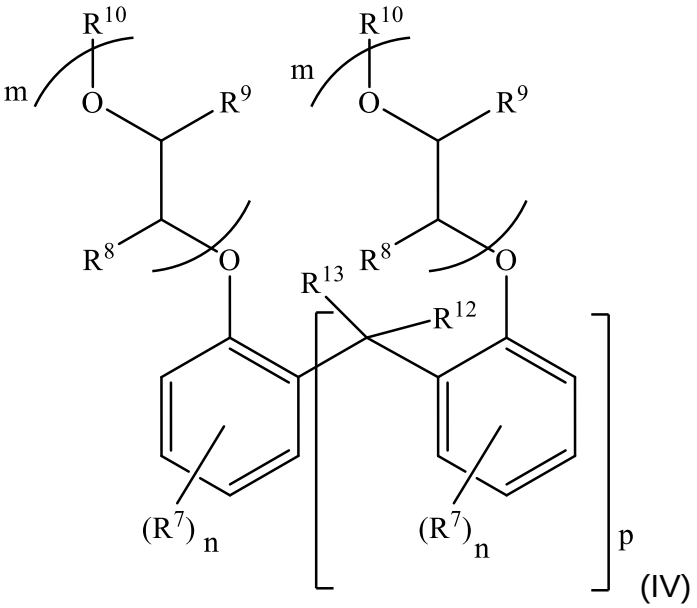

(I)


(II),

where each R^1, R^2, R^3, and R^4 is independently a hydrogen radical, hydrocarbyl radical, or hydrocarbylene radical, each R^5 and R^6 is independently a hydrogen radical, hydrocarbyl radical, or hydrocarbylene radical, wherein at least one of R^1, R^2, R^3, and R^4 is a hydrocarbyl or hydrocarbylene radical; and

    c. a polyalkoxylated hydrocarbyl phenol represented by formula (III) or (IV):


(III)



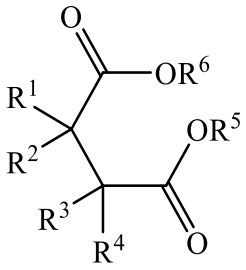
(IV)

where each R^7 is independently a hydrocarbyl or hydrocarbylene radical of 1 to 250 carbon atoms, each R^8 and R^9 is independently a hydrogen radical, hydrocarbyl radical of 1 to 6 carbon atoms, or hydrocarbylene radical of 1 to 6 carbon atoms; R^{10} is a hydrogen radical, hydrocarbyl radical of 1 to 24 carbon atoms, hydrocarbylene radical of 1 to 24 carbon atoms, or acyl radical represented by —C(═O)R^{11}, R^{11} is a hydrocarbyl or hydrocarbylene radical of 1 to 24 carbon atoms, R^{12} and R^{13} are independently a hydrogen radical, hydrocarbyl radical of 1 to 24 carbon atoms, or hydrocarbylene radical of 1 to 24 carbon atoms, n is 1 to 3, m is 1 to 50, and p is 1 to 50, and

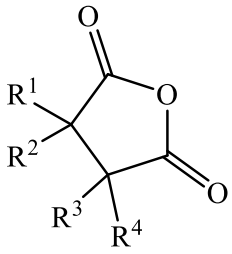
wherein the lubricating oil composition reduces corrosion in the engine of a hybrid vehicle as determined by the JIS K2246 test method.

6. The use of b) and c) as defined below in a lubricating composition comprising a) a major amount of an oil of lubricating viscosity, to improve the ability of the lubricating oil composition, when contaminated with water and fuel, to reduce corrosion in a hybrid engine as determined by the JIS K2246 test method; wherein:

b) is one or more compounds containing a carboxylic-acid functional group, ester functional group, or anhydride functional group represented by formula (I) or (II),



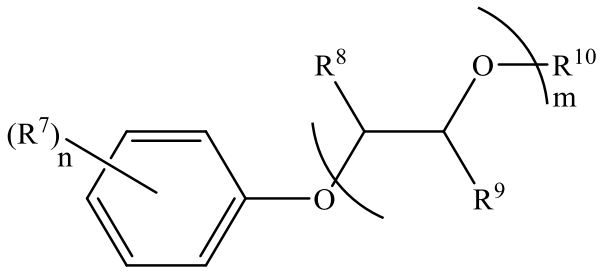
(I)



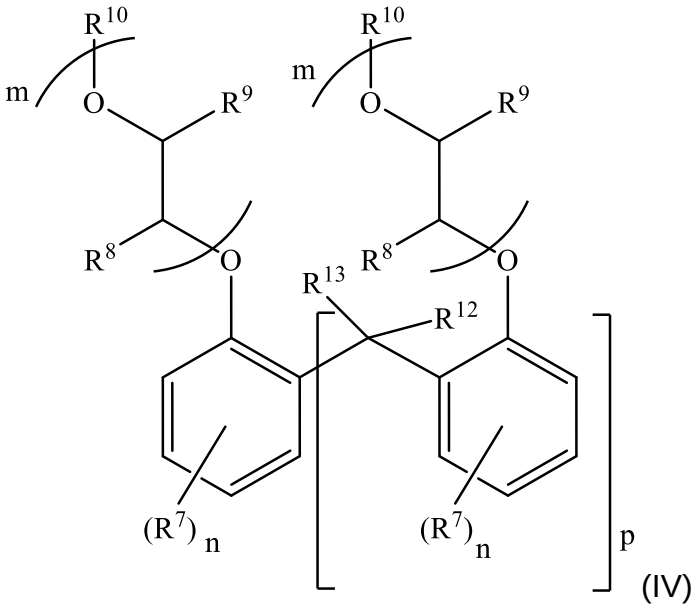
(II),

where each R^1, R^2, R^3, and R^4 is independently a hydrogen radical, hydrocarbyl radical, or hydrocarbylene radical, each R^5 and R^6 is independently a hydrogen radical, hydrocarbyl radical, or hydrocarbylene radical, wherein at least one of R^1, R^2, R^3, and R^4 is a hydrocarbyl or hydrocarbylene radical; and is present in an amount ranging from 0.05 to 3.0 wt.% based on total weight of the lubricating oil composition; and

c) is a polyalkoxylated hydrocarbyl phenol represented by formula (III) or (IV):



(III)



where each R^7 is independently a hydrocarbyl or hydrocarbylene radical of 1 to 250 carbon atoms, each R^8 and R^9 is independently a hydrogen radical, hydrocarbyl radical of 1 to 6 carbon atoms, or hydrocarbylene radical of 1 to 6 carbon atoms; R^{10} is a hydrogen radical, hydrocarbyl radical of 1 to 24 carbon atoms, hydrocarbylene radical of 1 to 24 carbon atoms, or acyl radical represented by —C(═O)R^{11}, R^{11} is a hydrocarbyl or hydrocarbylene radical of 1 to 24 carbon atoms, R^{12} and R^{13} are independently a hydrogen radical, hydrocarbyl radical of 1 to 24 carbon atoms, or hydrocarbylene radical of 1 to 24 carbon atoms, n is 1 to 3, m is 1 to 50, and p is 1 to 50, and is present in an amount ranging from 0.05 to 3.0 wt.% based on total weight of the lubricating oil composition.

7. Use according to claims 5 or 6, wherein the lubricating oil composition further comprises antioxidant, anti-wear agent, detergent, rust inhibitor, dehazing agent, demulsifying agent, metal deactivating agent, friction modifier, pour point depressant, antifoaming agent, co-solvent, corrosion-inhibitor, dispersant, multifunctional agent, dye, or extreme pressure agent.