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(54) **BORON NITRIDE BASED LUBRICANT ADDITIVE**

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(57) **ABSTRACT**

A food grade, low friction lubricant additive for use with oil-based lubricants. The additive comprises boron nitride in combination with a dispersant and an oil carrier.

BORON NITRIDE BASED LUBRICANT ADDITIVE

FIELD OF THE INVENTION

[0001] The present invention relates to food grade, low friction additives to be incorporated into oil based lubricants.

BACKGROUND OF THE INVENTION

[0002] The food manufacturing industry is constantly striving toward higher levels of performance by increasing manufacturing efficiency and decreasing manufacturing time. Among the improvements in the industry are faster manufacturing line speeds and higher operating temperatures. Both of these conditions can negatively affect the longevity and maintenance of the chains, gears and other movable parts utilized in the manufacturing process. Current lubrication technologies consist of graphite and/or additives, however these lubricants are not suitable for uses which may have incidental food contact. Further, bakery oven applications may experience temperatures as high as 1000° F. and existing food grade base oils can not perform at these extreme temperatures. Consequently, there is a need within the industry for food grade lubricant additives that will perform in the higher temperatures and other harsh conditions encountered during the food manufacturing process. Such lubricant additives would provide longer lubrication intervals, longer equipment life, and reduced maintenance and energy costs.

SUMMARY OF THE INVENTION

[0003] The present invention discloses a food grade, low friction additive for use with oil-based lubricants. The additive comprises boron nitride in combination with a dispersant and an oil carrier.

DETAILED DESCRIPTION OF THE PRESENT INVENTION

[0004] Food and other manufacturing processes utilize machinery consisting of chains, gears and other moving parts that require a high level of lubrication. The quality of the lubrication is critical to ensure the proper functioning of the equipment. Improperly lubricated equipment will have significant down time and require more frequent replacement and repair than properly lubricated equipment. Equipment utilized in food manufacturing processes has the further requirement that its lubricants must be approved for contact with food, thus severely limiting the potential lubricant ingredients. Oil-based lubricants are frequently utilized in the industry, however such lubricants require additional low friction additives to properly perform in the increasingly harsh environments encountered during the manufacturing processes. While it is stated throughout the application that the lubricant additives of the present invention are for use in food grade applications, it is to be understood that these lubricant additives may also be utilized in non-food grade applications where desired.

[0005] The lubrication additive of the present invention comprises boron nitride in combination with one or more dispersants and one or more oil carriers. The boron nitride is preferably a food grade hexagonal boron nitride having a particle size in the range of about 0.1 to about 10 microns with an average particle size in the range of about 1 to about 2 microns. One such boron nitride is AC6003, commercially available from GE Advanced Materials. The boron nitride component comprises in the range of about 0.5 to about 50 weight percent of the additive and preferably in the range of about 5 to about 20 weight percent of the additive.

[0006] The dispersant for the lubrication additive must be one that creates a stable food grade colloidal dispersion. Among the dispersants that may be utilized are alkylated polyvinylpyrrolidone modified with an α-olefin. Preferably the alkyl component of the polyvinylpyrrolidone varies from C-4 to C-30 linear moiety with concentrations in the range of about 10 to about 80%. One such dispersant is commercially available as GANEX V-216 from ISP. The dispersant may also be alkylated polyvinylpyrrolidone modified with eicosene, commercially available as GANEX V-220 (from ISP), alkylated polyvinylpyrrolidone modified with tricontanyl, commercially available as WP-660 from ISP, or alkylated polyvinylpyrrolidone modified with hexadecane, commercially available from ISP as GANEX V-516. Other examples of dispersants that may be employed include synthetic esters such as glycerol dioleate, isopropyl oleate, glycerol mono-oleate and mixtures thereof. Examples of such dispersant are PRIOLUBE 1406; PRIOLUBE 1407; PRIOLUBE 1408; PRIOLUBE 1409; and PRIOLUBE 1412, commercially available from Uniqema. The dispersant component comprises in the range of about 1 to about 30 weight percent of the additive and preferably in the range of about 5 to about 20 weight percent of the additive.

[0007] The oil carrier must be compatible with the dispersant. Preferably one or more synthetic carriers are utilized. Such synthetic carriers include polyalphaolefin and polyalkylene glycol. Food grade polyalphaolefins include SPECRASYN, commercially available from ExxonMobil and SYNFLUID, commercially available from Chevron Phillips. Commercially available polyakylene glycols include EMKAROX, commercially available from Uniqema, and PLURASAFE, commercially available from BASF. Synthetic carriers such as these are capable of providing proper lubrication additive properties under high temperatures and harsh conditions. The synthetic carrier component comprises in the range of about 45 to about 99 weight percent of the additive and preferably in the range of about 70 to about 80 weight percent of the additive. Non-synthetic oil carriers, including but not limited to, food grade white oils may also be used.

[0008] In a further embodiment of the present invention, the lubricant additive of the present invention is combined with an oil-based lubricant to form a lubricant package suitable for use in high temperatures and other harsh conditions. Exemplary oil-based lubricants to which the additive may be added include, but are not limited to, commercial-type oil-based lubricants. The method for forming such a lubricant would be to add the desired amount of the lubricant additive to an oil-based lubricant.

[0009] The invention may be further described by the following example which is merely to illustrate the invention and does not limit the scope of the invention.

EXAMPLE

[0010] Lubricant additives were made according to the following process. Boron nitride was added to the dispersant and thoroughly mixed. The initial processing may be com-

pleted by use of a commercial low shear mixer or kneader or via high speed dispersion using a cowles blade. The dispersion is continued for at least 14 hours using cooling water in a mill jacket to form a paste. When the boron nitride powder has been thoroughly mixed, any remaining dispersant should be added along with sufficient oil to thin the composition to a pourable consistency in the range of about 13 to about 15% solids. The blend is then filtered or centrifuged to maintain a maximum particle size of about 5 microns. Once this particle size is achieved, the material may be further thinned to the desired solids level.

[0011] For testing purposes, the additive concentrates were added to various carriers to form lubrication packages with about 1 to 2 weight percent solid lubricant additive. The lubrication packages are set forth in Table 1.

TABLE 1

	Lubrication Package Formulations				
Material	A (wt %)	B (wt %)	C (wt %)	D (wt %)	E (wt %)
Boron Nitride		1		0.2	1
Graphite			1		
PTFE				0.8	
Mineral Oil			99		
Ester				99	
Polyalkylene Glycol		99			
Polyalphaolefin	100				99

[0012] The lubrication packages listed in Table 1 were tested to determine their lubricating properties by measuring the amperage used by a motor while rotating a metal cylinder against a stationary cylinder. The lubrication packages were tested along with comparative formulation A, which is polyalphaolefin. The lubrication package was applied to the cylinders and the amperage was measured every five minutes. The test results are shown in Table 2.

TABLE 2

	Lubricant additive test results.					
	Time					
Formulation	Amperage 5 Minutes	Amperage 10 Minutes	Amperage 15 Minutes	Amperage 20 Minutes	Amperage 25 Minutes	Amperage 30 Minutes
A	10	10	9.8	9.7	9.7	10
B	9.5	9.3	9.5	9.5	9.1	9.
C	9.6	9	8.9	8.9	8.9	8.9
D	8.1	7.9	7.9	7.9	7.9	8
E	8.1	7.9	7.9	7.9	7.6	7.5

[0013] As shown in Table 2, the lubrication packages containing boron nitride provide superior lubrication, as evidenced by a reduction in the amperage required to rotate the cylinders.

[0014] Many modifications and variations of this invention can be made without departing from its spirit and scope, as will be apparent to those skilled in the art. The specific embodiments described herein are offered by way of example only, and the invention is to be limited only by the terms of the appended claims, along with the full scope of equivalents to which such claims are entitled.

We claim:

1. A lubricant additive comprising boron nitride, one or more dispersants and one or more oil carriers.

2. The lubricant additive of claim 1, wherein the oil carrier comprises one or more synthetic carriers.

3. The lubricant additive of claim 1, wherein the boron nitride is hexagonal boron nitride having a particle size in the range of about 0.1 to about 10 microns.

4. The lubricant additive of claim 1, wherein the dispersant is alkylated polyvinylpyrrolidone modified with one or more of the group consisting of a-olefins, eicosene, tricontanyl, hexadecane or mixtures thereof.

5. The lubricant additive of claim 4, wherein the alkyl component of the polyvinylpyrrolidone has a linear moiety in the range of from C-4 to C-30.

6. The lubricant additive of claim 1, wherein the dispersant comprises on or more synthetic esters.

7. The lubricant additive of claim 6, wherein the synthetic ester is selected from the group consisting of glycerol dioleate, isopropyl oleate, glycerol mono-oleate and mixtures thereof.

8. The lubricant additive of claim 2, wherein the synthetic carrier is selected from the group consisting of polyalphaolefin, polyalkylene glycol and mixtures thereof.

9. The lubricant additive of claim 1, wherein the lubricant additive is suitable for food grade applications.

10. The lubricant additive of claim 1, wherein the lubricant additive comprises in the range of about 0.5 to about 50 weight percent boron nitride.

11. The lubricant additive of claim 10, wherein the lubricant additive comprises in the range of about 5 to about 20 weight percent boron nitride.

12. The lubricant additive of claim 1, wherein the lubricant additive comprises in the range of about 5 to about 30 weight percent dispersant.

13. The lubricant additive of claim 1, wherein the lubricant additive comprises in the range of about 5 to about 20 weight percent dispersant.

14. The lubricant additive of claim 1, wherein the oil carrier comprises in the range of about 45 to about 99 weight percent synthetic carrier.

15. The lubricant additive of claim 14, wherein the oil carrier comprises in the range of about 70 to about 80 weight percent synthetic carrier.

16. An oil-based lubrication package comprising an oil-based lubricant and the lubricant additive of claim 1.

17. The lubricant additive of claim 1, wherein the oil carrier comprises one or more white oils

18. A method for forming an oil-based lubrication package comprising the step of adding the lubricant additive of claim 1 to an oil-based lubricant.

19. A food-grade lubricant additive comprising boron nitride, one or more dispersants and one or more synthetic oil carriers.

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