LeKem, Inc.
1863 Lammers Pike • Batesville, IN • 47006
www.lekem.com
Where Innovation and Quality Meet

MicroKoat™

**Antimicrobial Electroless Nickel

MicroKoat™ is the next generation of Electroless Nickel coatings on the market today with an antimicrobial preservative to inhibit the growth of odor-causing and spoilage organisms including bacteria, fungi and mildew on the treated article**. MicroKoat ™ has also shown reduction against the Human Coronavirus Strain 229E: ATCC VR-740***. **This product can also be used for everyday production.**

Advantages

- Stable, uniform rate / 8-10 metal turnovers.
- Non-magnetic coating.
- Controlled hardness, heat treatable.
- Excellent wear resistance, freedom from porosity.
- High tank stability.
- Compressively stressed deposit.
- Natural lubricity, providing excellent release properties.
- Self-polishing effect in molding operations.
- 10-13% phosphorus as plated.
- Easily waste treatable.

Deposit Properties:

Phosphorous Content	10-13 wt. %
Hardness	48-52 Rc as plated 68 Rc 750º F 1 1/2 Hours
Magnetic Properties	Non-magnetic as plated (at parameters) Non-magnetic 290º C 1 hour
Internal Stress	Compressive
Ductility	Pass (ASTM B-489)
Electrical Resistivity	70-100 micro ohm-cm
Melting Point	880° C
Neutral Salt Spray	Pass all ASTM B-117
NADCAP Testing	Pass all
MIL-SPEC	Pass all
Nitric Acid Test	Pass
Density	7.75 g/cc
ASTM G21 & JIS Z 2801	****Pass no growth detected/reduction**
Coronavirus, Strain: 229E	*****Reduction within 6 hours**
RoHs	*Pass

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*Lekem is not liable for drag in or contamination of bath once in tank.

Operating Data:

MicroKoat™ S	Bath make-up solution
MicroKoat™ N	Nickel replenisher
MicroKoat™ DH	Hypophosphate replenisher

Operating Instructions

1. A new bath should be made with 20 parts MicroKoat™ S and 80 parts DI water. Tanks should be previously calibrated to assure proper concentration. Tanks may now be half filled with DI water. MicroKoat™ S make up is added with agitation on. DI water is then added to bring the solution to the proper level. **In some instances LeKem will recommend you make up the bath at 90%. This will help with any under loading and or possible over stabilization of bath make-up. Please confer with LeKem representative before make-up of bath.**

2. PH should now be checked and adjusted to 4.6 with Aqua Ammonia. Always dilute ammonia 1:1 with DI water before adding. The same dilution applies to sulfuric acid if the pH ever needs to be brought below 5.0. The proper operating range is 4.6 to 4.8 .

3. Air must be turned on before turning on heat.

4. Filter should be turned on and remain on throughout the operation period.

5. The bath is heated to 180-190° F for normal operation. An optimum temperature of 185° F is desired. Making sure the heater thermostat is in the bath. Do not exceed 195° F.

6. Titration of bath should be used on the amount of work being processed.

7. Operation range of nickel content should be maintained between 85-95%.

8. Replenishment adds may be made during plating at a ratio of 1:1 N to DH. MicroKoat™ N is always added before MicroKoat™ DH. Replenishment should be made in 10% increments to eliminate possible over-concentration of the bath.

9. Bath pH is self-maintained by proper replenishment. If, however, the pH varies form the operation range due to excessive drag-in, it may be adjusted by following instructions in step #2. Dilution of this type of add with DI water is a must at operating temperature.

**This notice clarifies current EPA policy with respect to the scope of the "treated articles" in 40 CFR 152.25(a). This product MicroKoat™ contains an antimicrobial agent to prevent microorganisms from
degrading the treated article. Guards against degradation from microorganisms. This product MicroKoat™ does not protect users or others against bacteria, viruses, germs or other disease organisms. Always clean this product thoroughly after every use. LeKem, INC. did extensive testing with a certified lab out of real-life plating tanks. The end user will have to do their own testing and LeKem will not be responsible for misuse of this product, drag in from parts, operator error, improper use of the product, improper plating equipment specified by LeKem, INC. Please contact LeKem, INC. for our full disclosure on the MicroKoat™ product. ***Human Coronavirus Strain:229E, ATCC VR-740 was tested for efficacy for 6 hours. There are no minimum reduction levels to qualify as passing or an efficacious product.

ASTM International Method G21
Standard Practice for Determining Resistance of Synthetic Polymeric Materials to Fungi**

Sample	Incubation Time and Growth Score			
	Day 7	Day 14	Day 21	Day 28
Microchem Positive Control	4	4	4	4
Microchem Negative Control	0	0	0	0
MicroKoat Razor Blade	0	0	0	0

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Japanese Industrial Standard Z 2801
Antibacterial Products – Test for Antibacterial Activity and Efficacy**

Test Microorganism	Contact Time	Carrier Type	Log_{10} CFU/Carrier	Percent Reduction of Microorganism Relative to Control	Log_{10} Reduction of Microorganism Relative to Control
S. aureus ATCC 33592 (MRSA)	Time Zero	Microchem Control	5.60E+04	N/A	
	6 Hour	Microchem Control	3.75E+04		
		Microkoat 1	<1.00E+00	>99.9987%	>4.88
		Microkoat 4	<1.00E+00	>99.9987%	>4.88
		Microkoat 8	<1.00E+00	>99.9987%	>4.88

The limit of detection for this assay is 1 colony forming units and is reported as <1.00E+00 CFU/Carrier in the table above and as zero in the graph.

Test Microorganism	Contact Time	Carrier Type	Log_{10} CFU/Carrier	Percent Reduction of Microorganism Relative to Control	Log_{10} Reduction of Microorganism Relative to Control
S. aureus ATCC 6538	Time Zero	Microchem Control	2.85E+04	N/A	
	3 Hour	Microchem Control	8.50E+03		
		Microkoat 4	6.95E+02	91.82%	1.09
	6 Hour	Microchem Control	1.30E+04	N/A	
		Microkoat 8	<5.00E+00	>99.96%	>3.41

The limit of detection for this assay is 5 colony forming units and is reported as <5.00E+00 CFU/Carrier in the table above and as zero in the graph.

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Test Microorganism	Contact Time	Carrier Type	Log_{10} CFU/Carrier	Percent Reduction of Microorganism Relative to Control	Log_{10} Reduction of Microorganism Relative to Control
E. coli ATCC 8739	Time Zero	Microchem Control	2.65E+04	N/A	
	6 Hour	Microchem Control	2.23E+04		
		Microkoat 1	<1.00E+00	>99.9987%	>4.65
		Microkoat 4	<1.00E+00	>99.9987%	>4.65
		Microkoat 8	<1.00E+00	>99.9987%	>4.65

The limit of detection for this assay is 1 colony forming units and is reported as <1.00E+00 CFU/Carrier in the table above and as zero in the graph.

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Japanese Industrial Z 2801 Modified Test Method for Human Coronavirus Strain:229E ATCC VR-740***

RESULTS

Table 1: Virus Titer, Recovery, Time Zero and MK 116 at 6 hours

		Virus Titer	Time Zero	Recovery	MicroKoat MK 116
Cell Control		0 0 0 0	0 0 0 0	0 0 0 0	0 0 0 0
Dilution	10^{-1}	+ + + +	+ + + +	+ + + +	+ + + +
	10^{-2}	+ + + +	+ + + +	+ + + +	+ + + +
	10^{-3}	+ + + +	+ + + +	+ + + +	+ 0 + +
	10^{-4}	+ + + +	+ 0 + +	0 + + +	+ 0 0 0
	10^{-5}	0 0 + 0	0 0 0 0	0 0 + 0	0 0 0 0
	10^{-6}	0 0 0 0	0 0 0 0	0 0 0 0	0 0 0 0
$TCID_{50}$ per 0.1 ml		4.75 Log_{10}	4.55 Log_{10}	4.80 Log_{10}	3.80 Log_{10}
Log_{10} Reduction		N/A	N/A	N/A	1.00 Log_{10}
Percent Reduction		N/A	N/A	N/A	90.00%

Key: + = Virus recovered; 0 = Virus not recovered and/or no cytotoxicity observed;
T = Cytotoxicity observed

Table 2: Cytotoxicity and Test Substance Neutralization Control Results

		Cytoxicity Control	Neutralization Control
Cell Control		0 0 0 0	0 0 0 0
Dilution	10^{-1}	0 0 0 0	+ + + +
	10^{-2}	0 0 0 0	+ + + +
	10^{-3}	0 0 0 0	+ + + +
$TCID_{50}$ per 0.1 ml		≤0.80 Log_{10}	≤0.80 Log_{10}

Key: + = Virus recovered; 0 = Virus not recovered and/or no cytotoxicity observed;
T = Cytotoxicity observed