NANODIMENSION

Technical Datasheet

AME Materials for DragonFly® IV+

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Notice

End-of-Life Disposal:

At the end of its life cycle, the DragonFly® IV+ printer must be recycled according to local regulations and WEEE standards. Please contact your Nano-Dimension customer service representative for further details on proper disposal and recycling.

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1. Introduction

The DragonFly® IV+ system simultaneously deposits INSU™200 Dielectric Ink (DI) and AgCite® Conductive Ink (CI), enabling the production of Additively Manufactured Electronics (AME). By printing both inks concurrently at high print resolution, the system offers limitless design flexibility for a wide range of applications and industries, including:

- Medical devices.
- Aerospace and automotive components.
- RF/communications hardware.
- Antennas.
- Coils.
- Capacitors.
- In-circuit transformers.
- Embedded components.

2. INSU™200 Dielectric Ink (DI)

The DragonFly® IV+ system, paired with the advanced INSU™200 dielectric ink, offers an efficient and reliable solution for in-house fabrication of multilayer PCB prototypes.

2.1. Dielectric properties

The table below shows the dielectric constant (Dk) and the tangential loss (Df) as a function of frequency. These measurements were taken using a SPEAG DAK-TL3.5-P contact probe beam on the surface at 22°C ±3°C.

Table 1: INSU™200 Df - Dk

Frequency	200MHz	500MHz	1GHz	2GHz	5GHz	10GHz	15GHz	20GHz
Dielectric Constant (Dk)	3.04	3.03	3.01	2.98	2.94	2.93	2.92	2.91
Tangential Loss (Df)	0.02	0.01	0.02	0.02	0.02	0.02	0.02	0.02

2.2. Material Properties

The table below shows mechanical, physical, thermal and electrical Properties of INSU™200.

Property	INSU™200	Unit	Condition	Test Method
Df 20GHZ	0.02	°C	22±3°C	SPEAG DAK-TL3.5-P
Dk 20GHZ	2.91	°C	22±3°C	SPEAG DAK-TL3.5-P
Dielectric breakdown (Thickness 1.6mm)	35.2	kV		IPC-TM-650, 2.5.6
Volume resistivity	3.13E+08	MΩ•cm	After humidity conditioning	IPC-TM-650, 2.5.17.1
Surface resistivity	1.39E+07	MΩ	After humidity conditioning	IPC-TM-650, 2.5.17.1
Arc resistance	135	Sec	Thickness 1.5mm	IPC-TM-650, 2.5.1
Dimensional Stability	99.95	%	After thermal stress (4h, 105°C)	IPC-TM-650, 2.4.39
Moisture absorption	1.1	%		IPC-TM-650 2.6.28
Tensile strength	77	MPa	23 °C	ASTM D638
Elongation at break	9.6	%	23 °C	ASTM D638
Elastic Modulus	2.7	GPa	23 °C	ISO 527
Flexural strength	170	MPa	23 °C	IPC TM-650 2.4.4
Flexural Modulus	4	GPa	23 °C	IPC TM-650 2.4.4
Flexural elongation	4	%	23 °C	IPC TM-650 2.4.4
Impact Resistance (notched)	300	J/m	23 °C	ASTM D256
CTE (TMA) (thickness ≥ 0.5 mm)	91	ppm/°C	35°C-230°C	IPC-TM-650 2.4.24
Decomposition temp. (Td 2%) (TGA)	320	°C		IPC-TM-650 2.4.24.6
Decomposition temp. (Td 5%) (TGA)	350	°C		
Tg (DMA, 10 Hz, tan delta)	200	°C		IPC-TM-650 2.4.24.4
Thermal conductivity	0.181	W/mK	25°C ± 5°C	ASTM E1530-19
Density	1.266	g/cm3	23 °C/47% RH	ASTM D792-20
Roughness (Ra)	3.0	µm	Top	ISO 25178
	0.1	µm	Bottom	
%TML (outgassing)	1.00	%		ASTM 595-15
%CVCM (outgassing)	<0.01	%		ASTM 595-15
%WVR (outgassing)	0.42	%		ASTM 595-15

NOTE

Test methods are used as a reference for the testing methodology only. The IPC specifications for PCBs do not apply to AME technology.

3. AgCite® Conductive Ink (CI)

Winner of the IDTechEx Technical Development Materials 2018 Award, AgCite® conductive ink (Nanoparticle Silver Ink), is based on pure silver particles that have controlled characteristics such as shape and particle distribution.

This ensures that each batch of AgCite® nano-silver ink is suitable for a wide range of additive manufacturing for electronic applications, while maintaining excellent conductivity and adhesion. Furthermore, unlike regular metal powders that require high sintering temperatures, AgCite® nano-silver inks can achieve a sintering temperature low enough for compatibility with Nano-Dimension's dielectric Ink.

3.1. Material Properties

The table below shows the mechanical, physical, thermal and electrical Properties of AgCite®.

Property	AgCite® 90072	Remark/Test method
Conductivity related to bulk silver [1] at room temperature	For 100µm – 125µm traces the conductivity is 29% ± 4% For trace width ≥ 150um, the conductivity is 33% ± 4%	Printing & sintering conditions dependent
Max manual soldering temperature [°C]	320	Both Sn/Bi/Ag and Sn/Ag/Cu
Roughness Ra	Top surface <2µm, Bottom surface 0.25µm	IPC-TM-650, Method 2.2.22
Elementary analysis after sintering [%wt]	Ag: 96.1, C: 3.9	EDS (Energy Dispersive X-ray Spectroscopy) (Oxford) (Detection limit: 0.5%)

[1] Bulk silver conductivity = 6.30×10^7 (S/m) at 20°C.

4. Reliability & Regulation

- Printed electronic boards were tested for reliability according to IPC-650 standards and successfully passed HATS (Highly Accelerated Thermal Shock) testing over 500 thermal cycles, ranging from 0°C to 100°C.
- Both materials comply with RoHS regulation.

5. Material Safety Data Sheet (MSDS)

- INSU™200 safety data sheet
- AgCite® Safety data sheet

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