

# Cuming Microwave

Microwave Materials and  
Specialty Dielectrics

## Cuming Microwave

Founded in 1980 by noted materials scientist Dr. William R. Cuming, and now part of PPG, Cuming Microwave provides innovative materials for the microwave industry within several market segments including telecom, electronics, military and aerospace, automotive and medical. Our focus is the manufacture and development of Microwave materials that are used to absorb and shape electromagnetic energy.

Cuming Microwave is an ISO 9001:2008 manufacturer located in Avon, MA USA. Featuring C-RAM®, microwave and RF absorbing materials, turnkey Anechoic & EMC Chambers, and C-STOCK®, low-loss dielectric materials.

### Market segment – material guide

	Electronics	Telecommunications	Fiber optics	Wireless	Antenna	Medical	Defense	Test & measurement
C-RAM MT	°	°	°	°	°	°	°	°
C-RAM-MT FR	°	°	°	°	°	°	°	°
C-RAM LF	°	°	°	°	°	°	°	°
C-RAM AR	°	°	°	°	°	°	°	°
C-RAM FDSS	°	°	°	°	°	°	°	°
C-RAM FFS	°	°	°	°	°	°	°	°
C-RAM GDSS	°	°	°	°	°	°	°	°
C-RAM GDX	°	°	°	°	°	°	°	°
C-RAM FGMM	°	°	°	°	°	°	°	°
C-RAM FF-2	°	°	°	°	°	°	°	°
C-RAM FLX	°	°	°	°	°	°	°	°
C-RAM RGDS	°	°	°	°	°	°	°	°
C-RAM RGD	°	°	°	°	°	°	°	°
C-RAM KR	°	°	°	°	°	°	°	°
C-RAM KRS	°	°	°	°	°	°	°	°
C-RAM KFS	°	°			°		°	
C-RAM HC		°	°	°	°		°	
C-RAM SFC-HC								°



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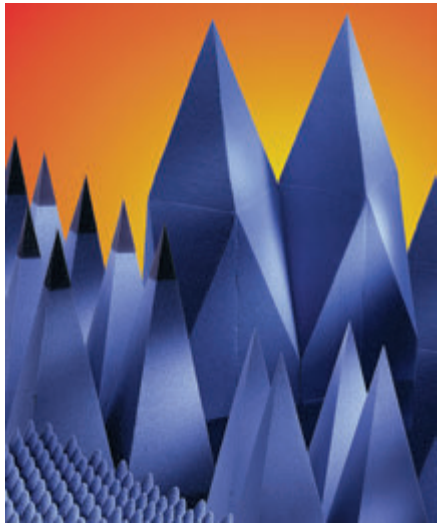
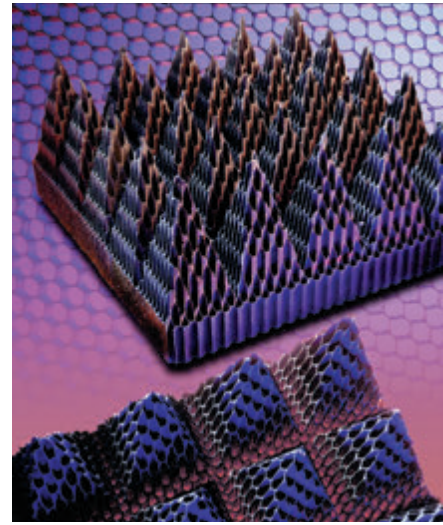
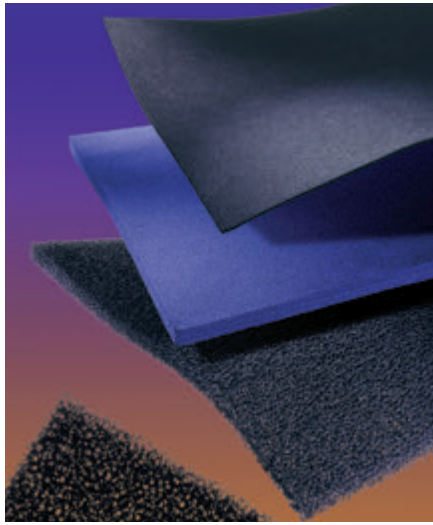
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**Foam absorbers**

Flat, thin dielectric absorbers, foam based. Products are either single or multi-layered foam that are electrically graded or separated by a resistive films. Excellent broad-banded and off-angle performance. Some products have Fire Retardant versions available. Products are used for antenna and signal shaping, preventing unwanted reflections and eliminating interference.

**Rubber absorbers**

Microwave absorbing tiles or sheets are tuned to specific frequencies or frequency bands. Materials are available in a selection of resins, and are ideal for electro-magnetic reduction, antenna signal shaping, and eliminating unwanted RF energy in electronic modules.

**Honeycomb & high power absorbers**

RF absorbers designed to operate at high temperatures and power. Power ratings > 10 Watts/inch<sup>2</sup>, with proper ventilation can be handled. Materials are lightweight and can be used for structural strength, as well as fabricated with pyramid shapes for use in anechoic chambers.

**Anechoic chambers & absorbers**

Cuming Microwave offers an extensive line of high performance absorbers, in convoluted and pyramid shape for maximum performance. These materials are designed for use in anechoic chambers, ranges and test boxes. Materials are available from 10 MHz to > 100 GHz. Cuming Microwave offers engineering services, construction and turn-key installation of anechoic chambers.

**Syntactic foam**

Lightweight dielectric and artificial dielectric materials or lossy materials using micro balloons and resins. Dielectric properties are controlled to tight tolerances. Applications include airborne application such as antennas and underwater applications where low weight is a factor.

**Rigid & castable absorbers**

Coatings designed for suppression of RF waves and currents traveling along conductive surfaces. Products are paint-like coatings that can be brushed or sprayed onto surfaces and complex shapes. Some products available as casting materials for suppression of energy in electronic units. Products are available in epoxy, silicone or urethane based resins. Thickness of material is dependent on frequency of use.

**Dielectric materials**

Materials with controlled dielectric constants and low loss tangents. Products have unique dielectric and physical properties, and are available in various forms; foam; rigid sheets, bars and rods; liquids and foam-in-place. Dielectric materials can be used as a dielectric spacer or circuit substrate, tapered permittivity transition, radome, RF lens, or other uses where a machined part of a specific dielectric constant is needed.

**Specialty products**

Cuming Microwave offers custom, engineered products for unique applications where standard products don't meet the criteria. Custom formulations and configurations are available, as well as valued added enhancements to our materials, such as pressure sensitive adhesive (PPGA and PSA), weatherproofing, and anti-dust coatings.

**Foam absorbers**

Product	C-RAM MT	C-RAM-MT FR	C-RAM LF	C-RAM AR	C-RAM LPJ
Function	Mode suppression	Lossy foam, suppression of RF energy meets UL 94 HB	Broadband absorber	Low cost broadband absorber	Mode suppression
Operating frequency	1 to 100 GHz	800 to 100GHz	600 MHz to 40 GHz	2 to 100GHz	1 to 100 GHz
Thickness	0.125" to 3.0"	0.125" to 4.00"	0.250" to 4.50"	0.125" & up	0.125" to 4.0"
Benefits	Low cost insertion loss material	Fire retardant low cost, lossy, flexible foam	Multi-layer graded carbon foam flexible sheet	Reticulated, flexible high and standard performance grades	

**Rubber absorbers**

Product	C-RAM FF-2	C-RAM FDSS	C-RAM FFS	C-RAM GDSS	C-RAM GDX	C-RAM FLX	C-RAM RGDS	C-RAM FGMM
Function	Low frequency, mode suppression	Mode suppression UHF frequency	Mode suppression	Mode suppression broadband	Mode suppression broadband	Narrow band, incident wave absorber	Mode suppression	UHF/RFID frequencies, reflection reduction
Operating frequency	800 MHz to 18 GHz	800 MHz to 18 GHz	800 MHz to 5.0 GHz	2 to 18 GHz	1 to 40 GHz	800 MHz to 35 GHz	800 MHz to 18 GHz	4 to 10 GHz
Thickness	0.020" and up	0.040" & up	.125" & .250"	0.020" & up	0.020" & up	.025" to .32"	0.010" & up	0.040"
Benefits	Thin, flexible	Thin, flexible	Flexible broadband magnetic sheet absorber	High loss magnetic sheet, flexible	High loss, dampen cavity resonances	Thin, flexible, tuned frequency magnetic sheet absorber	Flexible, silicone high loss stock	Thin, broadband

**Rigid & castable absorbers**

Product	C-RAM KR	C-RAM KRS	C-RAM KFS	C-RAM RGD
Function	Cast in place mode suppression	Cast in place mode suppression	Cast in place mode suppression	Mode suppression
Operating frequency	2 GHz & up	2 GHz & up	800 MHz to 5 GHz	800 MHz to 18 GHz
Thickness	As cast	As cast	As cast	.125" to 3.00"
Benefits	Epoxy casting resin	Silicone casting resin	Magnetic silicone casting resin for UHF frequencies	Epoxy, rigid, high loss stock

**Honeycomb & high power**

Product	C-RAM HC	C-RAM SFC-HC
Function	High power / high performance applications	High power
Operating frequency	500 MHz to 40 GHz	500 MHz and up
Thickness	0.125" to 18.0"	3.00" to 24.0"
Benefits	Broadband honeycomb absorbers flat sheet and pyramidal	Broadband, high performance and high temperature

**Syntactic foams**

Product	Epoxy
Function	Dielectric values between 1.25 to 5.0
Operating frequency	2.0 GHz & up
Thickness	Custom
Benefits	Dielectric or lossy properties available. Stock Sheets, castable or pack-in-place

**Anechoic chamber materials**

Product	C-RAM SFC	C-RAM SFC wedge	C-RAM SFC-EM	C-RAM FAC	C-RAM FT	C-RAM EVA	C-RAM CFC
Function	High performance pyramidal absorber	High performance wedge absorber	Truncated absorber for EMC chambers	High performance convoluted absorber	Low frequency	Open cell absorber for outdoor & ventilation applications	Clean room absorbers high performance
Operating frequency	100MHz & up	100MHz & up	60 MHz through 40 GHz	2 GHz & up	10 MHz & up	100 MHz & up	100 MHz to 30 GHz
Thickness	2.0" to 72"	6.0" to 24"	24", 30" and 36"	0.75" to 4.0"	0.250"	2.0" to 72"	4.0" to 36"
Benefits	Broadband high performance pyramidal absorber	Broadband wedge absorber	Low profile and rugged	High performance high frequency	0.250"	High power & ventilation applications outdoor pyramidal	Clean room environment

**Dielectric materials**

Product	C-stock AK	C-stock low K	C-stock 0005	C-stock RH	C-foam PF-2,-4
Function	Adj. dielectric material K=2.0-30.0 dielectric substrates loss tangent = 0.002	Low dielectric constant K=1.7-1.9 loss tangent = 0.004	Low loss sheet stock K=2.54 loss tangent = 0.0005	Low loss dielectric foam K=1.09 loss tangent = 0.0004	Flexible low loss foam K=1.03 loss tangent = 0.0001
Operating frequency	NA	NA	NA	NA	NA
Thickness	0.250" to 3.0" (T)	0.250" to 4.0" (T)	0.125" to 6.0" (T)	0.1" to 2.0"	0.125" to 0.250"
Benefits	Adjusted dielectric constant machinable	Rigid, low density, for antenna, waveguides	Easy to machine, waveguides and coaxial transmission lines	Low density, low dielectric properties, structural foam	Closed cell foam, dielectric substrates, radomes