

Metropolitan Museum of Art Gas Chromatography- Mass Spectrometry (GC-MS) Results from Material Analysis

This document includes (1) a mass spectrum and (2) the volatile organic compounds (VOCs) emitted from samples using GC-MS analysis. The data is not interpreted; however, several classes of chemicals are highlighted because they are potential risks for artwork in an enclosed environment. A basic key, provided below, indicates those classes. The amount of each chemical identified has not been determined; similarly, it is not known how much of each chemical is necessary to do damage to art. Finally, peaks may be present that are the result of the sample adsorbing chemicals from the air and reemitting them during testing rather than being inherent to the sample. Research is ongoing to determine specifically which chemicals and amounts are required to negatively affect artifacts.

Highlighted data:

Pink – chemicals currently known to be hazardous to art

Green – amines; can raise the pH, are suspected to react with acids and may form crystals in an enclosed environment

Yellow – chemicals of the following type, which *may* be hazardous to art:

Acids – lower the pH, corrosive to metals, degrade organic materials

Aldehydes – can convert to acids with heat or exposure to UV light

Esters – can hydrolyze into acids with heat and humidity

Sulfur-containing compounds – known to tarnish and corrode some metals

Halogenated compounds – can become reactive with exposure to heat and UV light

Nitrogen-containing, not amine – can react with other off-gassed chemicals

Alkynes – can become reactive when exposed to heat or UV light

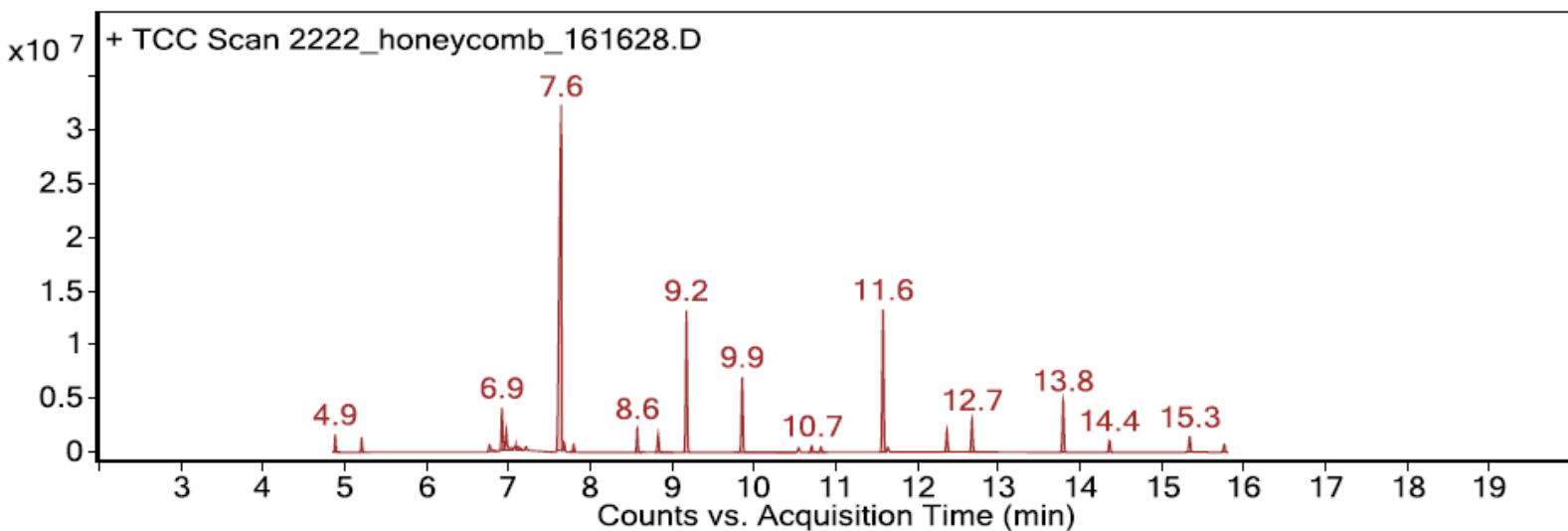
Sample: Honeycomb aluminum from Plascore

Oddy test result: Temporary

Date collected: 06/29/2018

Technique used: SPME with a PDMS/DVB fiber; Agilent 7890B GC and 5977B MS fitted with a GL Sciences OPTIC-4 multimode inlet and LEAP PAL RTC autosampler; Pre-heated at 60°C for 20 minutes; fiber exposure at 60°C for 20 minutes; sample injected into 220°C inlet and crotrapped for 2 min at -15°C; GC ramped from 40°C to 225 °C at 10°C/min. Data analyzed in masshunter Qualitative. Samples > 80% match with a NIST library are reported.

VOCs not highlighted are because they were also observed in blanks: (1) 12.4 min: 2-methyl-, 2,2-dimethyl-1-(2-hydroxyl-1-methylethyl) propyl ester propanoic acid; (2) 12.7 min: 2-methyl-, 3-hydroxyl-2,4,4-trimethylpentyl ester propanoic acid



Library results

RT	Score	Formula	MW	Area	CAS #	Name
4.900	92.5	C6H18O3Si3	222.1	1427189	541-05-9	Cyclotrisiloxane, hexamethyl-
6.900	92.6	C8H24O4Si4	296.1	4372189	556-67-2	Cyclotetrasiloxane, octamethyl-
7.200	87.9	C7H16O3	148.1	1791259	0-00-0	dipropylene glycol monomethyl ether isomer, STRUCTURE UNKNOWN
7.600	94.4	C7H9N	107.1	61680452	100-45-8	4-Cyanocyclohexene
7.700	96.7	C8H18O	130.1	772541	104-76-7	1-Hexanol, 2-ethyl-
7.800	95.7	C7H8O	108.1	992101	100-51-6	Benzyl Alcohol
8.800	95.2	C9H18O	142.1	2069978	124-19-6	Nonanal
9.200	95.5	C10H30O5Si5	370.1	16809164	541-02-6	Cyclopentasiloxane, decamethyl-
10.700	93.8	C7H5NS	135.0	874767	95-16-9	Benzothiazole
10.800	88.9	C10H22O3	190.2	728337	29911-28-2	2-Propanol, 1-(2-butoxy-1-methylethoxy)-
11.600	95.9	C12H36O6Si6	444.1	18638585	540-97-6	Cyclohexasiloxane, dodecamethyl-
11.600	95.0	C13H28	184.2	618244	629-50-5	Tridecane
12.400	90.6	C12H24O3	216.2	2808421	74367-33-2	Propanoic acid, 2-methyl-, 2,2-dimethyl-1-(2-hydroxy-1-methylethyl)propyl ester
12.700	93.2	C12H24O3	216.2	4278510	74367-34-3	Propanoic acid, 2-methyl-, 3-hydroxy-2,4,4-trimethylpentyl ester
13.800	80.3	C14H42O7Si7	518.1	6805656	107-50-6	Cycloheptasiloxane, tetradecamethyl-
14.400	80.6	C15H24O	220.2	1414625	999235-71-9	4P-2P
15.300	94.5	C15H28	208.2	2158683	54934-90-6	Cyclohexane, 1,1'-(1-methylethylidene)bis-
15.800	90.5	C16H48O8Si8	592.2	1150097	556-68-3	Cyclooctasiloxane, hexadecamethyl-