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

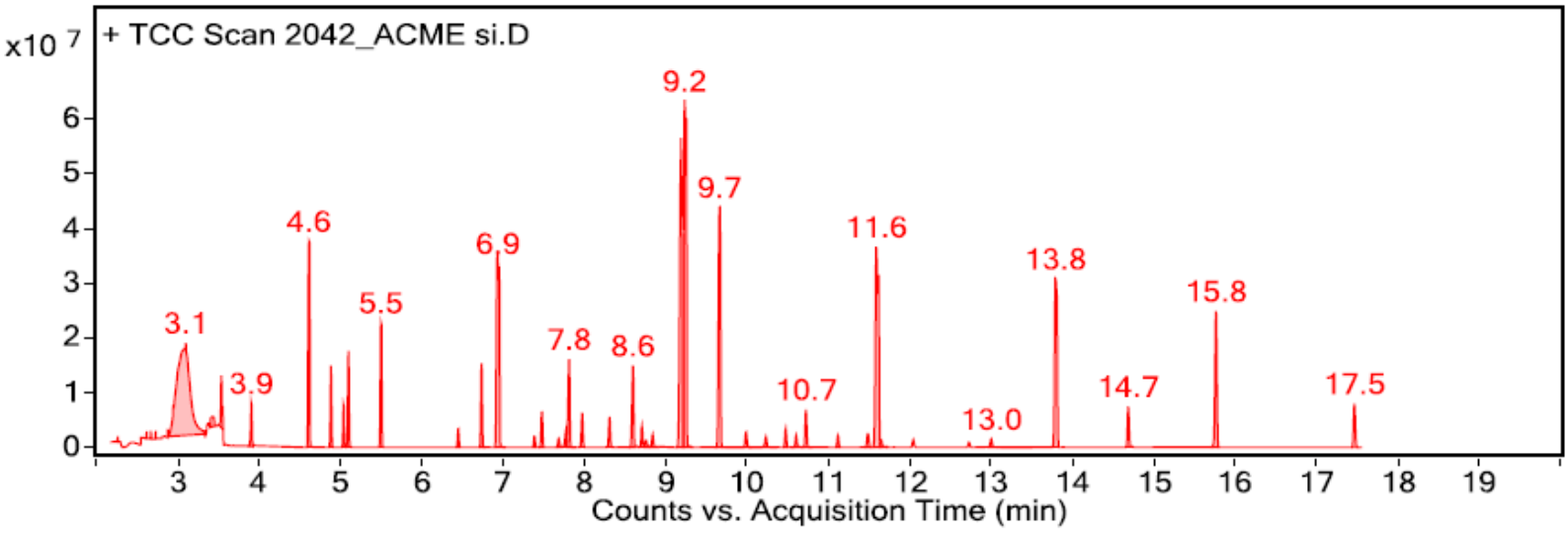
Alkynes – can become reactive when exposed to heat or UV light

Sample: Acme Rubber 0.125” clear silicone rubber sheeting

Oddy test result: Permanent

Date GC-MS collected: 03/09/2018

Technique used: SPME Arrow 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 sample at 60°C for 20 minutes; fiber exposure to sample at 60°C for 20 minutes; fiber injected into 220°C inlet and cryotrapped 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.



RT	Score	Formula	MW	Area	CAS #	Name
2.400	87.9	C5H16OSi2	148.1	8389012	1438-82-0	Disiloxane, pentamethyl-
3.500	93.2	C3H10OSi	90.1	16625909	1066-40-6	Silanol, trimethyl-
3.900	95.4	C6H18OSi2	162.1	8462378	107-46-0	Disiloxane, hexamethyl-
4.900	95.7	C6H18O3Si3	222.1	13376549	541-05-9	Cyclotrisiloxane, hexamethyl-
5.000	91.0	C7H22O2Si3	222.1	7459928	1873-88-7	1,1,1,3,5,5,5-Heptamethyltrisiloxane
5.100	90.1	C7H22O2Si3	222.1	17131777	1873-88-7	1,1,1,3,5,5,5-Heptamethyltrisiloxane
5.500	93.9	C8H24O2Si3	236.1	25201846	107-51-7	Trisiloxane, octamethyl-
6.900	82.1	C8H24O4Si4	296.1	65996021	556-67-2	Cyclotetrasiloxane, octamethyl-
7.700	97.4	C8H18O	130.1	2188266	104-76-7	1-Hexanol, 2-ethyl-
7.800	86.2	C10H16	136.1	3664554	138-86-3	dl-Limonene
7.800	95.9	C7H8O	108.1	19277466	100-51-6	Benzyl Alcohol
8.000	94.1	C10H30O3Si4	310.1	7729940	141-62-8	Tetrasiloxane, decamethyl-
8.300	99.0	C8H8O	120.1	6908687	98-86-2	Ethanone, 1-phenyl-
8.600	91.9	C9H12O	136.1	20725914	617-94-7	Benzenemethanol, .alpha.,.alpha.-dimethyl-
8.800	89.2	C11H24	156.2	1517712	1120-21-4	Undecane
8.800	97.4	C9H18O	142.1	2847253	124-19-6	Nonanal
9.700	97.1	C12H36O4Si5	384.1	75990949	141-63-9	Pentasiloxane, dodecamethyl-
10.200	95.0	C12H26	170.2	2660683	112-40-3	Dodecane
10.500	97.3	C12H36O4Si5	384.1	4334676	141-63-9	Pentasiloxane, dodecamethyl-
10.600	95.0	C11H20O2	184.1	2594608	42928-87-0	4-(Prop-2-enoyloxy)octane
10.700	81.9	C10H30O5Si5	370.1	8643045	541-02-6	Cyclopentasiloxane, decamethyl-
11.500	84.8	C13H40O5Si6	444.1	3986509	38147-00-1	1,1,1,5,7,7,7-Heptamethyl-3,3-bis(trimethylsiloxy)tetrasiloxane

11.600	95.9	C12H36O6Si6	444.1	91921805	540-97-6	Cyclohexasiloxane, dodecamethyl-
12.000	95.2	C14H42O5Si6	458.2	1941216	107-52-8	Hexasiloxane, tetradecamethyl-
12.700	92.3	C14H42O5Si6	458.2	1336091	107-52-8	Hexasiloxane, tetradecamethyl-
13.000	94.3	C14H30	198.2	2180193	629-59-4	Tetradecane
13.800	82.6	C14H42O7Si7	518.1	67865522	107-50-6	Cycloheptasiloxane, tetradecamethyl-
14.700	80.1	C18H52O7Si7	576.2	9848808	71579-69-6	3-Isopropoxy-1,1,1,7,7,7-hexamethyl-3,5,5-tris(trimethylsiloxy)tetrasiloxane
15.800	87.9	C16H48O8Si8	592.2	39182901	556-68-3	Cyclooctasiloxane, hexadecamethyl-
17.500	85.0	C18H54O9Si9	666.2	11814511	556-71-8	Cyclononasiloxane, octadecamethyl-