

Supporting Information

Roll-to-Roll Printing of Silver Oxide Pastes and Low-temperature Decomposition

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NMR, IR, APCI-MS, elemental analysis data of synthesized silver neoalkanoate.

Silver neohexanoate ($\text{AgCO}_2\text{C}(\text{CH}_3)_2\text{C}_2\text{H}_5$): Starting acid (2,2-dimethylbutanoic acid) was purchased from TCI. From 2,2-dimethylbutyric acid (6.96 g; 60 mmol); yield 11.84 g (88%). ^1H -NMR (TFA-d), δ : 0.83 (3H, t, $J=7.5$ Hz, CH_3), 1.10, 1.15 (each 3H, br. s, 2 CH_3 -2), 1.58 (2H, m, $J=7.5$ Hz, CH_2 -3). ^{13}C -NMR (TFA-d), δ : 189.85, 45.07, 35.10, 25.20, 9.63. IR (neat), cm^{-1} : 1516, 1389 (COO^-). APCI-MS (negative mode), m/z : 115 $[\text{M-Ag}]^-$. Calcd. for $\text{C}_6\text{H}_{11}\text{AgO}_2$: C, 32.31; H, 4.97; Ag, 48.37. Found: C, 32.10; H, 4.90; Ag, 48.81.

Silver neoocnoate ($\text{AgCO}_2\text{C}(\text{CH}_3)_2\text{C}_4\text{H}_9$): Starting acid (2,2-dimethylhexanoic acid) was purchased from TCI. From 2,2-dimethylhexanoic acid (5.04 g; 35 mmol); yield 8.31 g (95%). ^1H -NMR (TFA-d), δ : 0.80 (3H, m, $J=7$ Hz, CH_3 -6), 1.17 (6H, s, 2 CH_3 -2), 1.19-1.25 (4H, m, CH_2 -4 + CH_2 -5), 1.57 (2H, m, CH_2 -3). ^{13}C -NMR (TFA-d), δ : 189.97, 44.68, 42.32, 28.88, 25.73, 24.69, 14.38. IR (neat), cm^{-1} : 1515, 1389 (COO^-). APCI-MS (negative mode), m/z : 143 $[\text{M-Ag}]^-$. Calcd. for $\text{C}_8\text{H}_{15}\text{AgO}_2$: C, 38.27; H, 6.02; Ag, 42.96. Found: C, 38.70; H, 6.28; Ag, 43.35.

Silver neodecanoate ($\text{AgCO}_2\text{C}(\text{CH}_3)_2\text{C}_6\text{H}_{13}$): 2,2-Dimethyloctanoic acid was prepared from hexyl bromide (14 ml, 100 mmol). Yield 10.09 g (59%), b.p. 106-108°C/3 torr. ^1H -NMR (dmsO-d_6), δ : 0.85

(3H, t, J=6.5 Hz, CH₃), 1.06 (6H, s, 2 CH₃-2), 1.19-1.27 (8H, m, CH₂-4...CH₂-7), 1.41 (2H, m, J=6.5 Hz, CH₂-3), 12.00 (1H, br. s., COOH). ¹³C-NMR (TFA-d), δ: 189.67, 44.66, 42.62, 33.56, 31.57, 26.70, 25.84, 24.35, 14.77. IR (film), cm⁻¹: 2500-3200 (OH), 1696, 939 (C=O). MS, m/z: 29, 43, 57, 71, 79, 88 (100), 101, 115, 127, 143, 157, 172 (M⁺).

Silver neodecanoate was prepared from 2,2-dimethyloctanoic acid (10.0 g; 58 mmol); yield 15.75g (97 %). ¹H-NMR (TFA-d), δ: 0.87 (3H, t, CH₃), 1.27 (6H, br.s, 2CH₃-2), 1.28-1.38 (8H, m, CH₂-4...CH₂-7), 1.65 (2H, m, CH₂-3). ¹³C-NMR (TFA-d), δ: 189.93, 44.70, 42.59, 33.46, 31.46, 26.64, 25.74, 24.26, 14.62. IR (neat), cm⁻¹: 1515, 1390 (COO⁻). APCI-MS (negative mode), m/z: 171 [M-Ag]⁻. Calcd. for C₁₀H₁₉AgO₂: C, 43.03; H, 6.83; Ag, 38.64. Found: C, 43.24; H, 7.05; Ag, 39.03

Silver neododecanoate (AgCO₂C(CH₃)₂C₈H₁₇): 2,2-Dimethyldodecanoic acid was prepared from octyl bromide (17.4 ml, 100 mmol). Yield 9.98 g (50%), b.p. 102-104°C/0.3 torr. ¹H-NMR (dmsd-d₆), δ: 0.85 (3H, t, J=6.5 Hz, CH₃), 1.06 (6H, s, 2 CH₃-2), 1.16-1.28 (12H, m, CH₂-4...CH₂-9), 1.42 (2H, m, J=6.5 Hz, CH₂-3), 11.99 (1H, br. s., COOH). ¹³C-NMR (TFA-d), δ: 189.79, 44.70, 42.65, 33.85, 31.92, 31.31, 31.21, 26.77, 25.86, 24.46, 14.85. IR (film), cm⁻¹: 2500-3200 (OH), 1697, 940 (C=O). MS, m/z: 29, 41, 57, 71, 79, 88 (100), 101, 115, 129, 143, 155, 164, 185, 200 (M⁺).

Silver neododecanoate was prepared from 2,2-dimethyldodecanoic acid (9.90 g; 49 mmol); yield 14.70g (98%). ¹H-NMR (TFA-d), δ: 0.87 (3H, t, CH₃), 1.27 (6H, br.s, 2CH₃-2), 1.26-1.36 (12H, m, CH₂-4...CH₂-9), 1.66 (2H, m, CH₂-3). ¹³C-NMR (TFA-d), δ: 189.97, 44.71, 42.59, 33.74, 31.79, 31.18, 31.08, 26.68, 25.74, 24.34, 14.68. IR (neat), cm⁻¹: 1515, 1390 (COO⁻). APCI-MS (negative mode), m/z: 199 [M-Ag]⁻. Calcd. for C₁₂H₂₃AgO₂: C, 46.92; H, 7.55; Ag, 35.12. Found: C, 47.20; H, 7.85; Ag, 35.68

Silver neotetradecanoate (AgCO₂C(CH₃)₂C₁₀H₂₁): 2,2-Dimethyldodecanoic acid was prepared from decyl bromide (20.7 ml, 100 mmol). Yield 14.4 g (63%), b.p. 122-124°C/0.2 torr. ¹H-NMR (dmsd-d₆), δ: 0.85 (3H, t, J=6.5 Hz, CH₃), 1.06 (6H, s, 2 CH₃-2), 1.17-1.30 (16H, m, CH₂-4...CH₂-11), 1.41 (2H, m, J=6.5 Hz, CH₂-3), 12.00 (1H, br. s., COOH). ¹³C-NMR (TFA-d), δ: 189.81, 44.70, 42.64, 33.91, 31.91, 31.54, 31.52, 31.33, 31.29, 26.76, 25.83, 24.47, 14.84. IR (film), cm⁻¹: 2500-3200 (OH), 1696,

941 (C=O). MS, m/z: 29, 41, 57, 69, 79, 88 (100), 101, 115, 129, 143, 157, 171, 183, 199, 213, 228 (M^+).

Silver neotetradecanoate was prepared from 2,2-dimethyldodecanoic acid (14.40 g; 63 mmol); yield 20.26g (96%). $^1\text{H-NMR}$ (TFA-d), δ : 0.83 (3H, t, CH_3), 1.23 (6H, br.s, 2CH_3-2), 1.22-1.32 (16H, m, $\text{CH}_2-4\ldots\text{CH}_2-11$), 1.61 (2H, m, CH_2-3). $^{13}\text{C-NMR}$ (TFA-d), δ : 189.89, 44.71, 42.61, 33.85, 31.83, 31.48, 31.46, 31.26, 31.23, 26.70, 25.78, 24.41, 14.77. IR (neat), cm^{-1} : 1514, 1390 (COO^-). APCI-MS (negative mode), m/z: 227 [$M-\text{Ag}$] $^-$. Calcd. for $\text{C}_{14}\text{H}_{27}\text{AgO}_2$: C, 50.16; H, 8.12; Ag, 32.18. Found: C, 50.37; H, 8.60; Ag, 32.71.

Silver neohexadecanoate ($\text{AgCO}_2\text{C}(\text{CH}_3)_2\text{C}_{12}\text{H}_{25}$): 2,2-Dimethyltetradecanoic acid was prepared lauryl bromide (23.9 ml, 100 mmol). Yield 13.62 g (53%), b.p. 142-144°C/0.2 torr, crystallized after distillation, m.p. 62-64°C. $^1\text{H-NMR}$ (dms o-d_6), δ : 0.86 (3H, t, $J=6.5$ Hz, CH_3), 1.06 (6H, s, 2CH_3-2), 1.16-1.30 (20H, m, $\text{CH}_2-4\ldots\text{CH}_2-13$), 1.42 (2H, m, $J=6.5$ Hz, CH_2-3), 12.00 (1H, br. s., COOH). $^{13}\text{C-NMR}$ (TFA-d), δ : 189.68, 44.69, 42.67, 34.01, 31.99, 31.72, 31.69, 31.67, 31.62, 31.43, 26.82, 25.91, 24.57, 15.00. IR (film), cm^{-1} : 2500-3200 (OH), 1696, 941 (C=O). MS, m/z: 43, 57, 71, 88 (100), 101, 115, 129, 143, 157, 171, 185, 199, 211, 223, 241, 256 (M^+).

Silver neohexadecanoate was prepared from 2,2-dimethyltetradecanoic acid (13.6 g; 53 mmol); yield 18.60g (97%). $^1\text{H-NMR}$ (TFA-d), δ : 0.86 (3H, t, CH_3), 1.27 (6H, br.s, 2CH_3-2), 1.27-1.36 (20H, m, $\text{CH}_2-4\ldots\text{CH}_2-13$), 1.66 (2H, m, CH_2-3). $^{13}\text{C-NMR}$ (TFA-d), δ : 189.81, 44.69, 42.62, 33.92, 31.88, 31.61, 31.60, 31.57, 31.51, 31.32, 26.73, 25.82, 24.47, 14.87. IR (neat), cm^{-1} : 1515, 1390 (COO^-). APCI-MS (negative mode), m/z: 255 [$M-\text{Ag}$] $^-$. Calcd. For $\text{C}_{16}\text{H}_{31}\text{AgO}_2$: C, 52.90; H, 8.60; Ag, 29.69. Found: C, 53.25; H, 9.04; Ag, 30.17.