

Supplementary information

Molecular topology-driven benzocyclobutene-based ultralow dielectrics with copper-matched low thermal expansion

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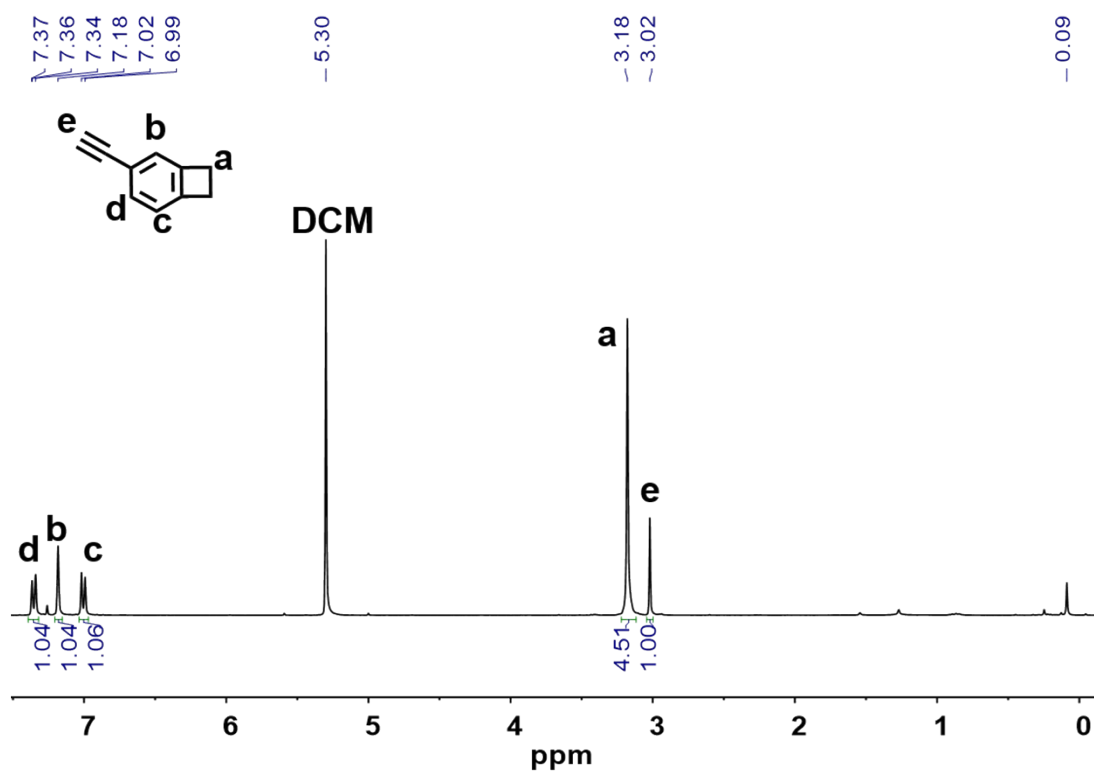


Fig.S1 The ^1H NMR of 4-ethynyl benzocyclobutene.

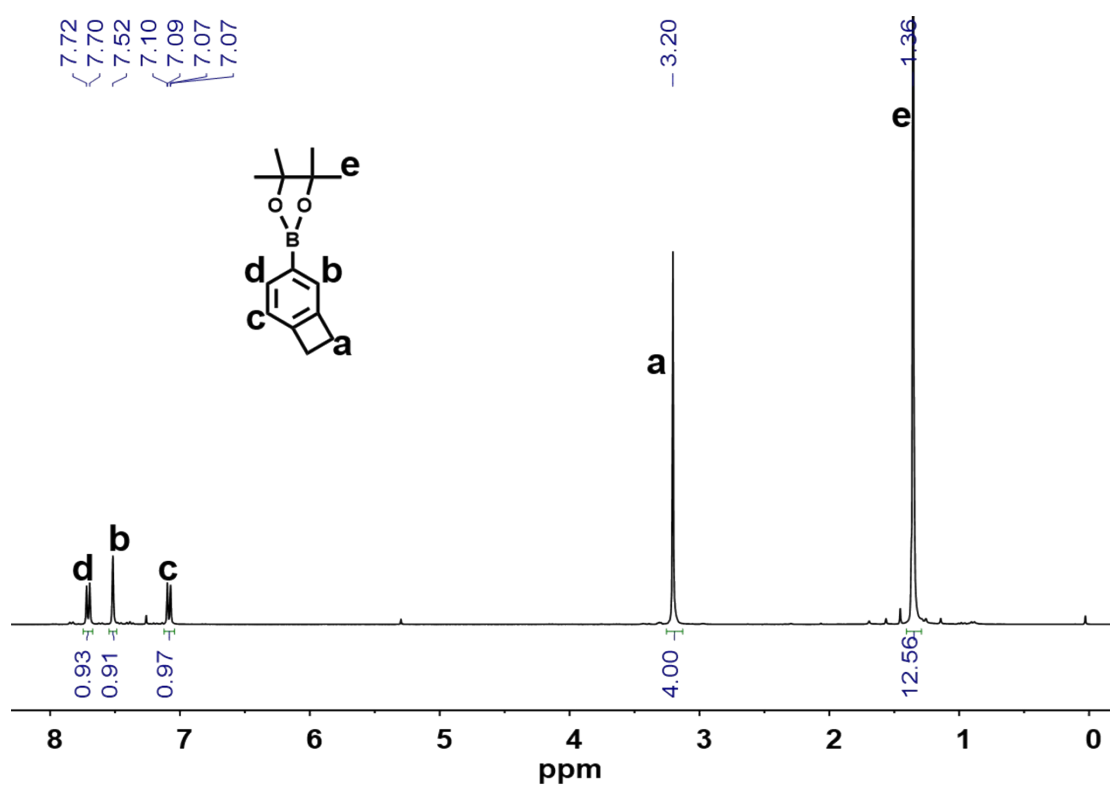


Fig.S2 The ^1H NMR of 4-pinacyl borate benzocyclobutene.

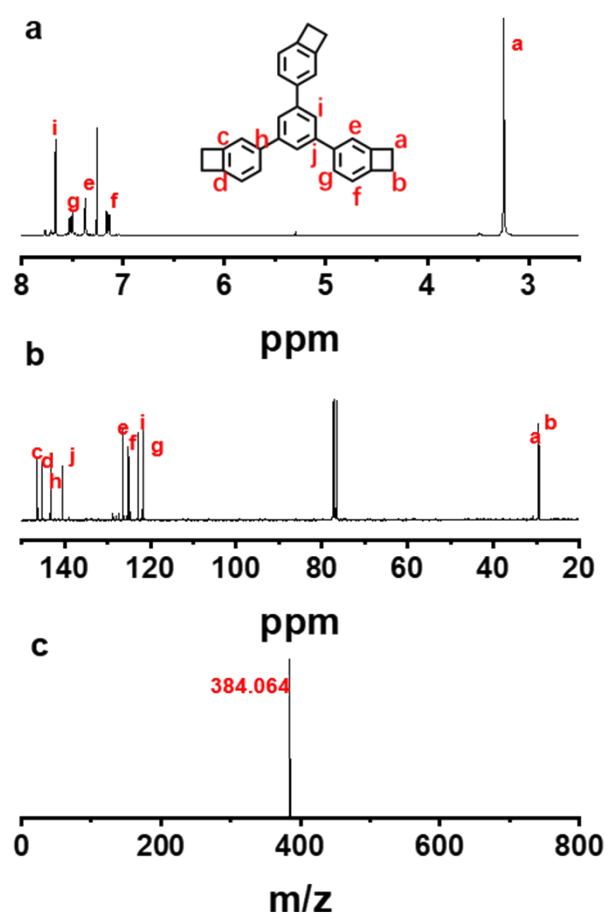


Fig.S3 ^1H NMR (A), ^{13}C NMR (B) and MALDI-TOF (C) of Ph-BCB.

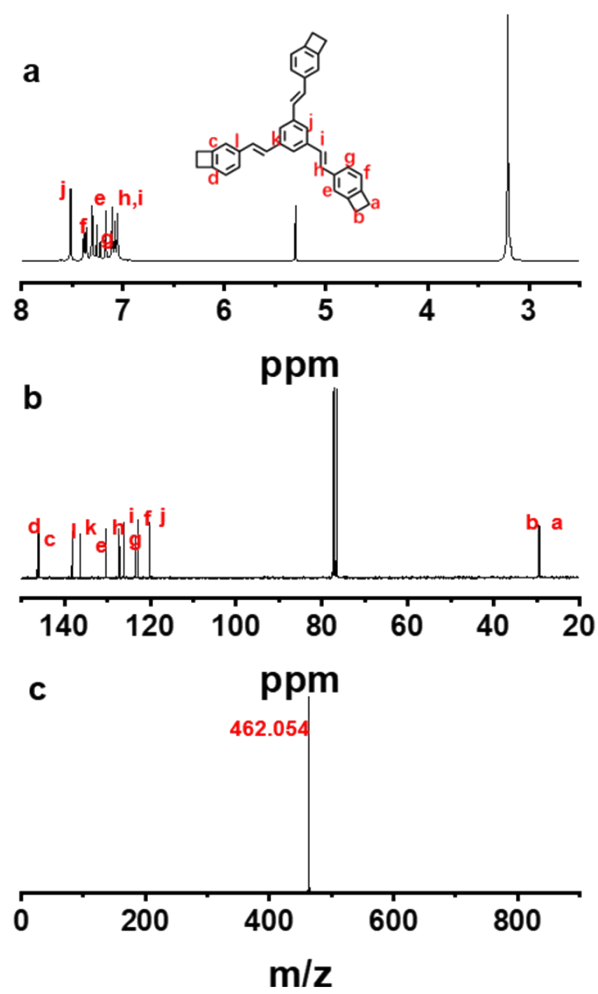


Fig.S4 ^1H NMR (A), ^{13}C NMR (B) and MALDI-TOF (C) of Ph-ene-BCB.

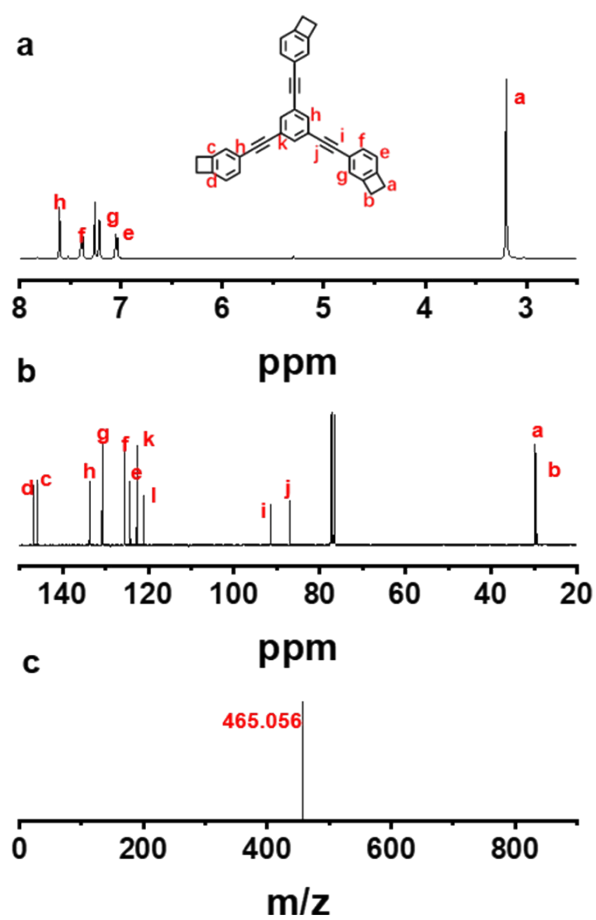


Fig.S5 ^1H NMR (A), ^{13}C NMR (B) and MALDI-TOF (C) of Ph-yne-BCB.

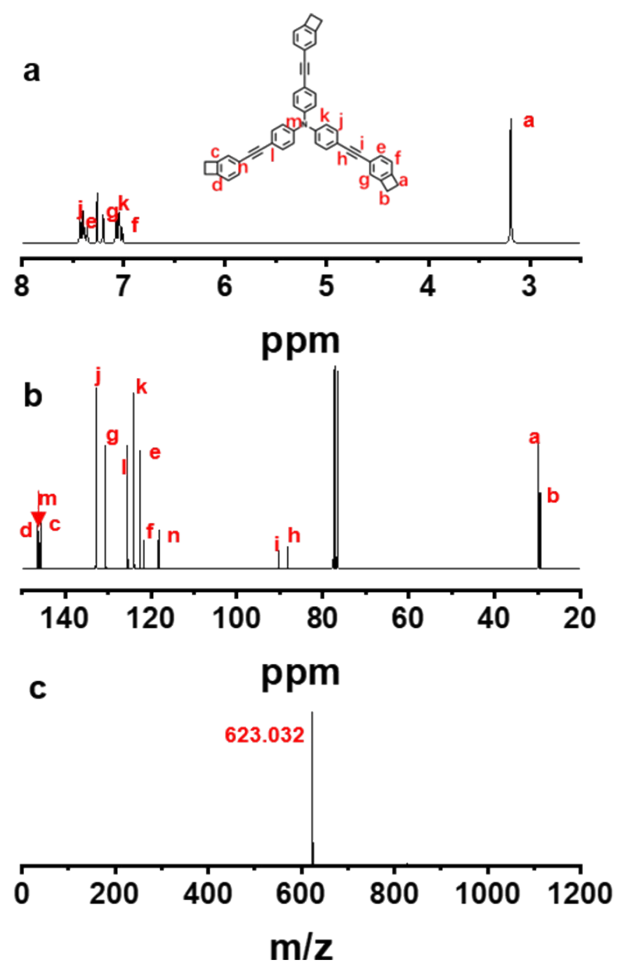


Fig.S6 ^1H NMR (A), ^{13}C NMR (B) and MALDI-TOF (C) of TPA-yne-BCB.

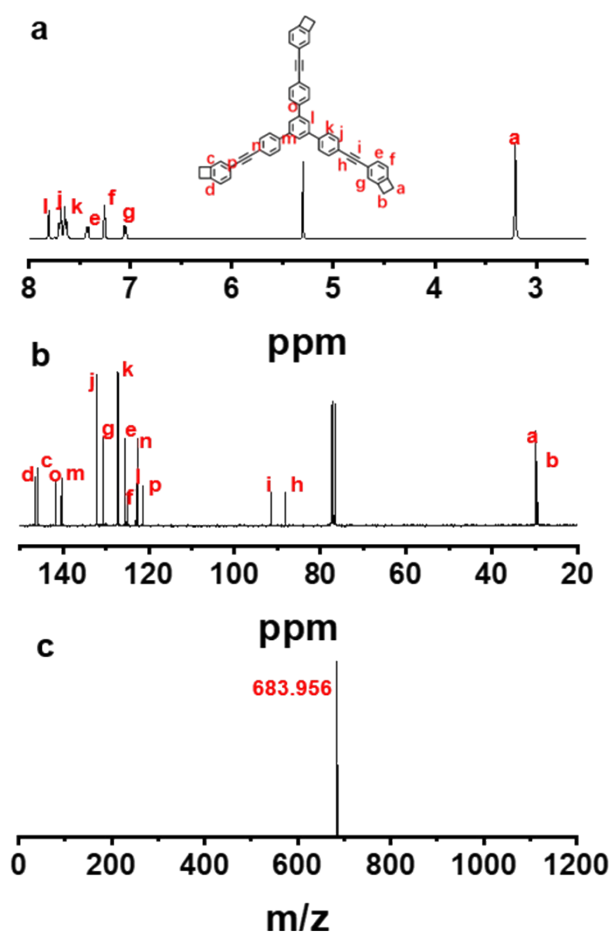


Fig.S7 ^1H NMR (A), ^{13}C NMR (B) and MALDI-TOF (C) of TPB-yne-BCB.

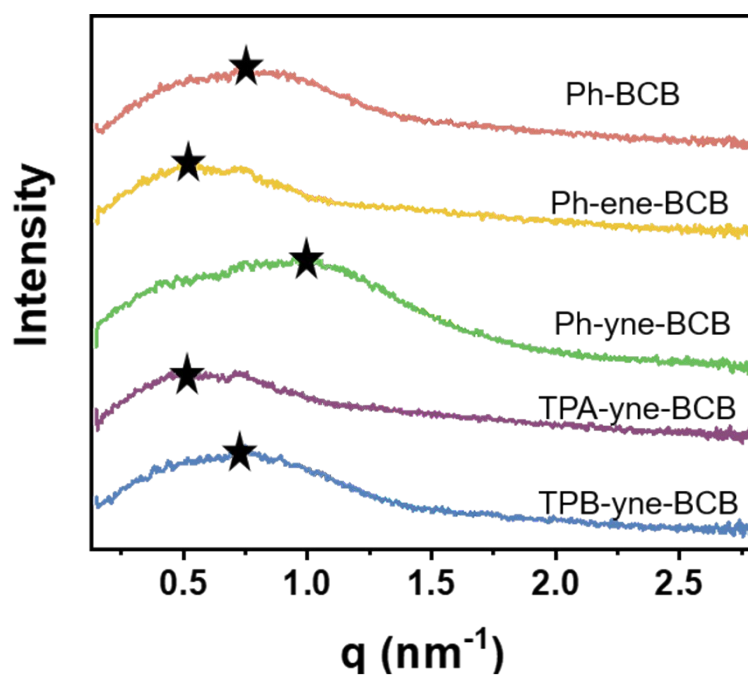


Fig.S8 The WAXS pattern of resins.

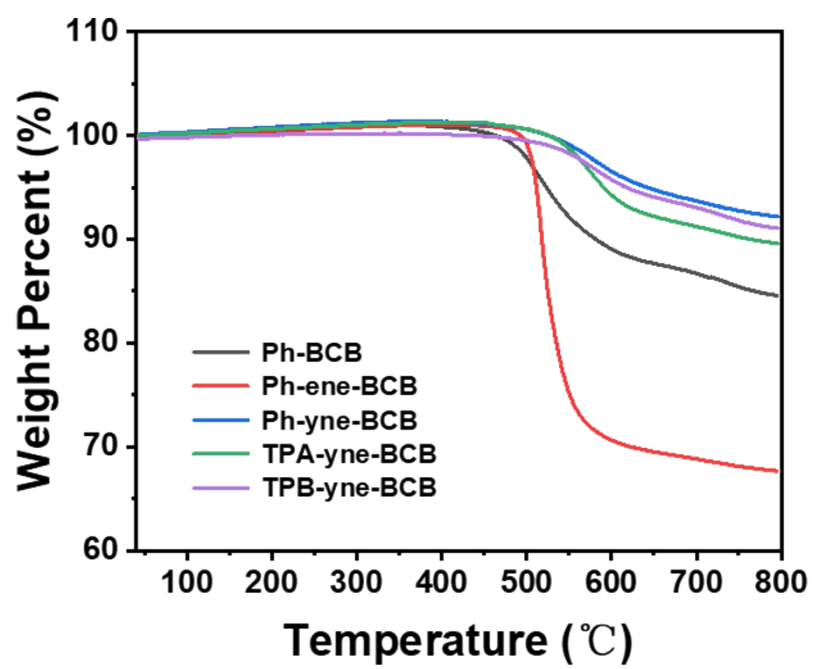


Fig.S9 TGA curves of cured resins.

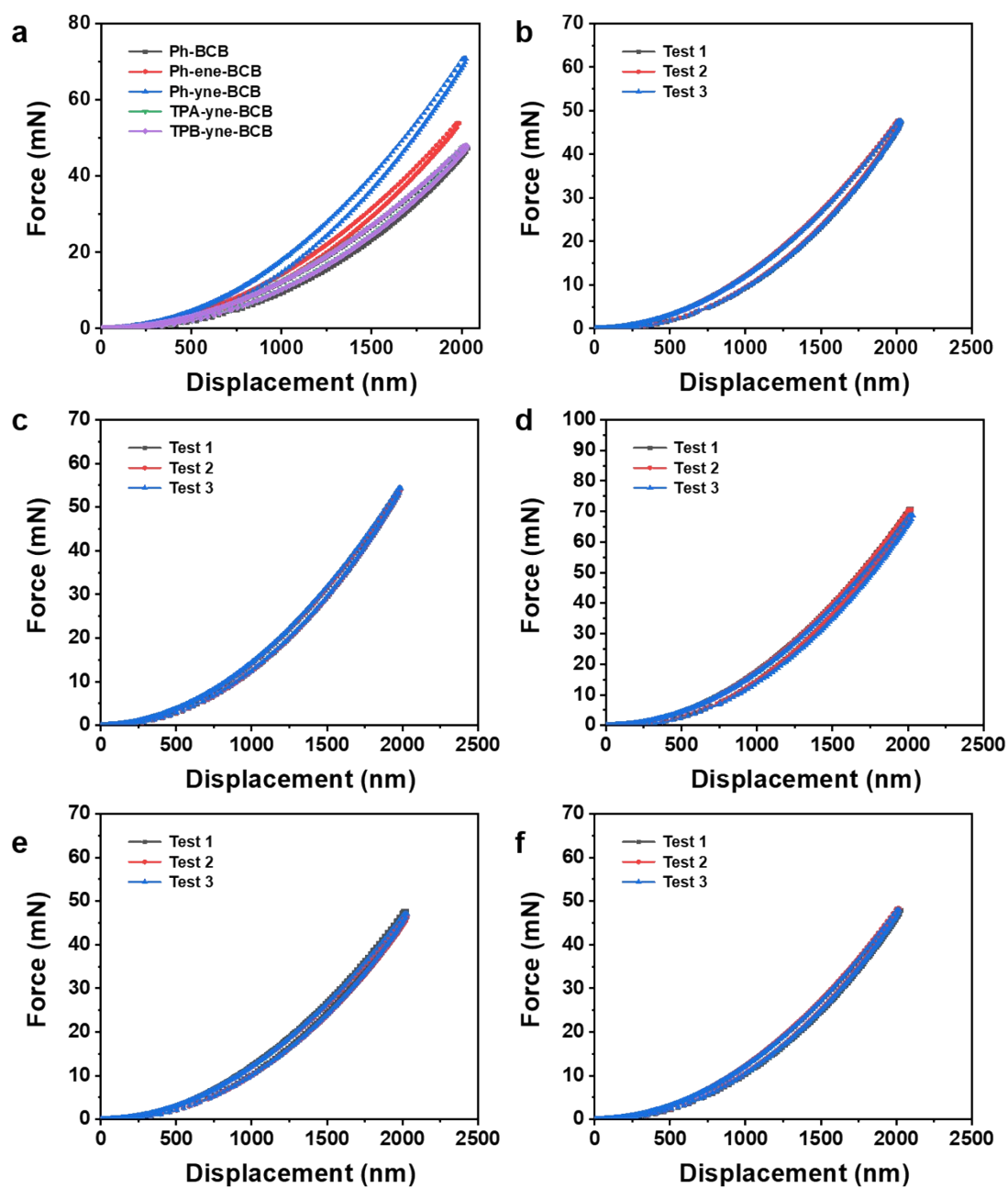


Fig.S10 Nanoindentation load-unload curves with displacement into surface of cured resins (a), Ph-BCB (b), Ph-ene-BCB (c), PH-yne-BCB (d), TPA-yne-BCB (e), and TPB-yne-BCB (f).