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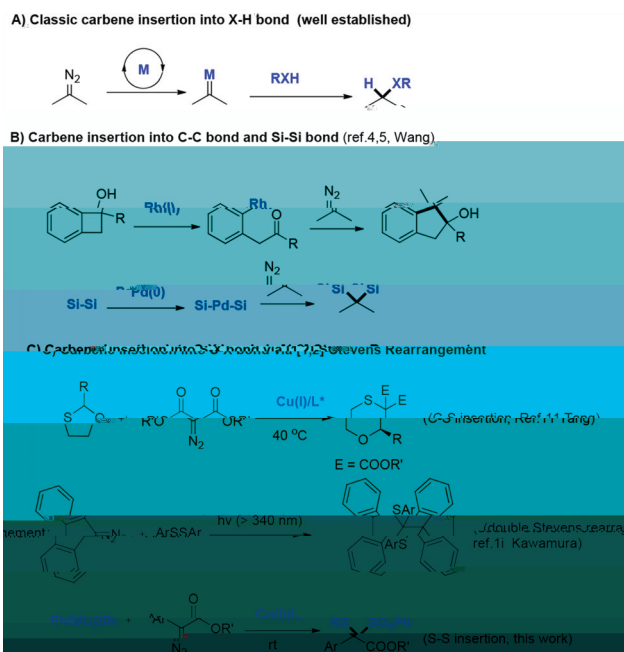
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Copper-catalyzed carbene insertion into the sulfur–sulfur bond of benzenesulfonothioate†

Hairui Yuan,^a Thirupathi Nuligonda,^a Hongyin Gao,^a Chen-Ho Tung^a and Zhenghu Xu ^{a,b}

An unprecedented copper-catalyzed intermolecular sulfur–sulfur bond insertion between aryldiazoacetates and benzenesulfonothioate has been successfully developed. Diverse α -disulfur functionalized esters were synthesized in good to excellent yields. The sulfur ylide formation and subsequent Stevens rearrangement are considered as the key steps for the discovered reaction.



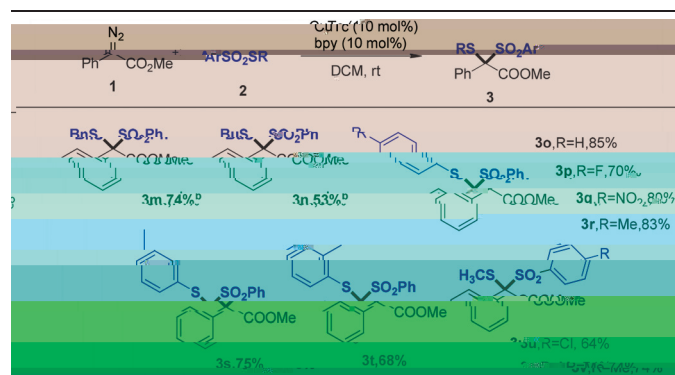
Scheme 1 Catalytic carbene insertion into σ bonds.

^aKey Lab for Colloid and Interface Chemistry of Education Ministry, School of Chemistry and Chemical Engineering, Shandong University, Jinan 250100, People's Republic of China. E-mail: xuzh@sdu.edu.cn

^bState Key Laboratory of Organometallic Chemistry Shanghai Institute of Organic Chemistry, Chinese Academy of Sciences, Shanghai 200032, PR China

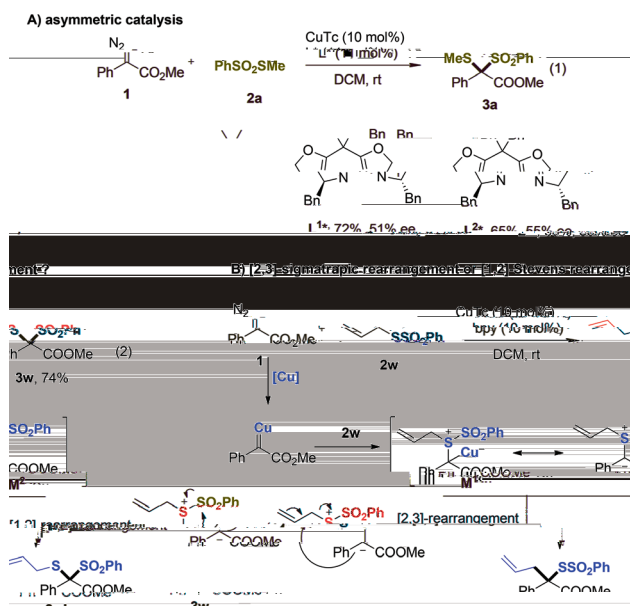
† Electronic Supplementary Information (ESI) available: [Details]. See DOI: 10.1039/c7qo01131h

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Table 3 Substrate scope of benzenesulfonothioate^a

^a 1 (0.4 mmol), 2 (0.2 mmol), CuTc (10 mol%), bpy (10 mol%), DCM, rt, 12 h. ^b Yield.

3g, 3h, 3i, 3j, 3k, 3l, 3m, 3n, 3o, 3p, 3q, 3r, 3s, 3t, 3u, 3v, 3w, 3x, 3y, 3z, 3aa, 3ab, 3ac, 3ad, 3ae, 3af, 3ag, 3ah, 3ai, 3aj, 3ak, 3al, 3am, 3an, 3ao, 3ap, 3aq, 3ar, 3as, 3at, 3au, 3av, 3aw, 3ax, 3ay, 3az, 3ba, 3bb, 3bc, 3bd, 3be, 3bf, 3bg, 3bh, 3bi, 3bj, 3bk, 3bl, 3bm, 3bn, 3bo, 3bp, 3bq, 3br, 3bs, 3bt, 3bu, 3bv, 3bw, 3bx, 3by, 3bz, 3ca, 3cb, 3cc, 3cd, 3ce, 3cf, 3cg, 3ch, 3ci, 3cj, 3ck, 3cl, 3cm, 3cn, 3co, 3cp, 3cq, 3cr, 3cs, 3ct, 3cu, 3cv, 3cw, 3cx, 3cy, 3cz, 3da, 3db, 3dc, 3dd, 3de, 3df, 3dg, 3dh, 3di, 3dj, 3dk, 3dl, 3dm, 3dn, 3do, 3dp, 3dq, 3dr, 3ds, 3dt, 3du, 3dv, 3dw, 3dx, 3dy, 3dz, 3ea, 3eb, 3ec, 3ed, 3ee, 3ef, 3eg, 3eh, 3ei, 3ej, 3ek, 3el, 3em, 3en, 3eo, 3ep, 3eq, 3er, 3es, 3et, 3eu, 3ev, 3ew, 3ex, 3ey, 3ez, 3fa, 3fb, 3fc, 3fd, 3fe, 3ff, 3fg, 3fh, 3fi, 3fj, 3fk, 3fl, 3fm, 3fn, 3fo, 3fp, 3fq, 3fr, 3fs, 3ft, 3fu, 3fv, 3fw, 3fx, 3fy, 3fz, 3ga, 3gb, 3gc, 3gd, 3ge, 3gf, 3gg, 3gh, 3gi, 3gj, 3gk, 3gl, 3gm, 3gn, 3go, 3gp, 3gq, 3gr, 3gs, 3gt, 3gu, 3gv, 3gw, 3gx, 3gy, 3gz, 3ha, 3hb, 3hc, 3hd, 3he, 3hf, 3hg, 3hi, 3hj, 3hk, 3hl, 3hm, 3hn, 3ho, 3hp, 3hq, 3hr, 3hs, 3ht, 3hu, 3hv, 3hw, 3hx, 3hy, 3hz, 3ia, 3ib, 3ic, 3id, 3ie, 3if, 3ig, 3ih, 3ii, 3ij, 3ik, 3il, 3im, 3in, 3io, 3ip, 3iq, 3ir, 3is, 3it, 3iu, 3iv, 3iw, 3ix, 3iy, 3iz, 3ja, 3jb, 3jc, 3jd, 3je, 3jf, 3jg, 3jh, 3ji, 3jj, 3jk, 3jl, 3jm, 3jn, 3jo, 3jp, 3jq, 3jr, 3js, 3jt, 3ju, 3jv, 3jw, 3jx, 3jy, 3jz, 3ka, 3kb, 3kc, 3kd, 3ke, 3kf, 3kg, 3kh, 3ki, 3kj, 3kk, 3kl, 3km, 3kn, 3ko, 3kp, 3kq, 3kr, 3ks, 3kt, 3ku, 3kv, 3kw, 3kx, 3ky, 3kz, 3la, 3lb, 3lc, 3ld, 3le, 3lf, 3lg, 3lh, 3li, 3lj, 3lk, 3ll, 3lm, 3ln, 3lo, 3lp, 3lq, 3lr, 3ls, 3lt, 3lu, 3lv, 3lw, 3lx, 3ly, 3lz, 3ma, 3mb, 3mc, 3md, 3me, 3mf, 3mg, 3mh, 3mi, 3mj, 3mk, 3ml, 3mm, 3mn, 3mo, 3mp, 3mq, 3mr, 3ms, 3mt, 3mu, 3mv, 3mw, 3mx, 3my, 3mz, 3na, 3nb, 3nc, 3nd, 3ne, 3nf, 3ng, 3nh, 3ni, 3nj, 3nk, 3nl, 3nm, 3no, 3np, 3nq, 3nr, 3ns, 3nt, 3nu, 3nv, 3nw, 3nx, 3ny, 3nz, 3oa, 3ob, 3oc, 3od, 3oe, 3of, 3og, 3oh, 3oi, 3oj, 3ok, 3ol, 3om, 3on, 3oo, 3op, 3oq, 3or, 3os, 3ot, 3ou, 3ov, 3ow, 3ox, 3oy, 3oz, 3pa, 3pb, 3pc, 3pd, 3pe, 3pf, 3pg, 3ph, 3pi, 3pj, 3pk, 3pl, 3pm, 3pn, 3po, 3pp, 3pq, 3pr, 3ps, 3pt, 3pu, 3pv, 3pw, 3px, 3py, 3pz, 3qa, 3qb, 3qc, 3qd, 3qe, 3qf, 3qg, 3qh, 3qi, 3qj, 3qk, 3ql, 3qm, 3qn, 3qo, 3qp, 3qq, 3qr, 3qs, 3qt, 3qu, 3qv, 3qw, 3qx, 3qy, 3qz, 3ra, 3rb, 3rc, 3rd, 3re, 3rf, 3rg, 3rh, 3ri, 3rj, 3rk, 3rl, 3rm, 3rn, 3ro, 3rp, 3rq, 3rr, 3rs, 3rt, 3ru, 3rv, 3rw, 3rx, 3ry, 3rz, 3sa, 3sb, 3sc, 3sd, 3se, 3sf, 3sg, 3sh, 3si, 3sj, 3sk, 3sl, 3sm, 3sn, 3so, 3sp, 3sq, 3sr, 3ss, 3st, 3su, 3sv, 3sw, 3sx, 3sy, 3sz, 3ta, 3tb, 3tc, 3td, 3te, 3tf, 3tg, 3th, 3ti, 3tj, 3tk, 3tl, 3tm, 3tn, 3to, 3tp, 3tq, 3tr, 3ts, 3tt, 3tu, 3tv, 3tw, 3tx, 3ty, 3tz, 3ua, 3ub, 3uc, 3ud, 3ue, 3uf, 3ug, 3uh, 3ui, 3uj, 3uk, 3ul, 3um, 3un, 3uo, 3up, 3uq, 3ur, 3us, 3ut, 3uu, 3uv, 3uw, 3ux, 3uy, 3uz, 3va, 3vb, 3vc, 3vd, 3ve, 3vf, 3vg, 3vh, 3vi, 3vj, 3vk, 3vl, 3vm, 3vn, 3vo, 3vp, 3vq, 3vr, 3vs, 3vt, 3vu, 3vv, 3vw, 3vx, 3vy, 3vz, 3wa, 3wb, 3wc, 3wd, 3we, 3wf, 3wg, 3wh, 3wi, 3wj, 3wk, 3wl, 3wm, 3wn, 3wo, 3wp, 3wq, 3wr, 3ws, 3wt, 3wu, 3wv, 3ww, 3wx, 3wy, 3wz, 3xa, 3xb, 3xc, 3xd, 3xe, 3xf, 3xg, 3xh, 3xi, 3xj, 3xk, 3xl, 3xm, 3xn, 3xo, 3xp, 3xq, 3xr, 3xs, 3xt, 3xu, 3xv, 3xw, 3xx, 3xy, 3xz, 3ya, 3yb, 3yc, 3yd, 3ye, 3yf, 3yg, 3yh, 3yi, 3yj, 3yk, 3yl, 3ym, 3yn, 3yo, 3yp, 3yq, 3yr, 3ys, 3yt, 3yu, 3yv, 3yw, 3yx, 3yy, 3yz, 3za, 3zb, 3zc, 3zd, 3ze, 3zf, 3zg, 3zh, 3zi, 3zj, 3zk, 3zl, 3zm, 3zn, 3zo, 3zp, 3zq, 3zr, 3zs, 3zt, 3zu, 3zv, 3zw, 3zx, 3zy, 3zz.

**Scheme 3** Asymmetric reactions and proposed mechanism.

Conflicts of interest

Acknowledgements

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Notes and references

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