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## Supporting Information

# Sol-gel-derived hard coatings from tetraethoxysilane and organoalkoxysilanes bearing zwitterionic and isothiazolinone groups and their antifouling behaviors

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## Figure S1



Fig. S1 Photos of (a) BIT and (b) BITS.

## Figure S2



Fig. S2 UV-Vis transmittance spectra of A- $\chi$ , Z- $\chi$  and S- $\chi$  coatings.

Figure S3



**Fig. S3** AFM height images (5  $\mu$ m × 5  $\mu$ m) and the corresponding  $R_q$  values of (a) A- $\chi$ , (b) Z- $\chi$  and (c) S- $\chi$  coatings.

### **Figure S4**

************	A-0 S-0 Z-0 means controlling it, without simultaneously creating that mon-target species is a considerable tailenge. Recent years in fundamental science behind the processes involved in biofou- ings and direr non-coating technologies. The main driver for some highly effective AF paints, notably the sector ributy in and regulatory regime on the use of alternative biocides. technologies the therefore urgently soughts of alternative biocides rechnologies the therefore urgently soughts of alternative biocides reproperties to dier deter organisms from attaching in the first properties to dier deter organisms from attaching in the first increase the addresion strength of those that do attach, so that directs generated by ship movement or mild mechanical de shift	A-0.125 S-0.125 Z-0.125 mon-target species is a considerable challenge. Recent years have fundamental science behind the processes involved in biofuel ings and other non-coating technologies. The pain driver be some highly effective AF paints, notably the use of alternative biocides interest in developing biocide-free coatings that rely on surface proprietes of either deter organisms from attaching in the first or reduce the adhesion strength of those that do autach, so that brokes generated by ship movement or mild mechanical cleanin
	A-0.5. S-0.5 Z-0.5 mon-target species is a considerable challenge. Recent years in fundamental science behind the processes involved in biolstal ings and other non-coating technologies. The main driver to some highly effective AP paints, notably the use of tributyin tion and regulatory regime on the use of alternative biocids, technologies are therefore urgently sought by the marine coating properties to either deter organisms from attaching in the first or reduce the adhesion strength of those that do attach, so that forces generated by ship movement or mild mechanical design	A-1 S-1 Z-1 practice porcease controlling its without simultaneously creating of indom-target species is a considerable challenge. Recent years li- fundamental science behind the processes involved in biofu- ings and other non-coating technologies. The main driver is some highly effective AF paints, notably the use of tributyfi tion and regulatory regime on the use of alternative biocides technologies are therefore urgently sought by the marine coatini interest in developing biocide-free coatings that rely on surface properties to either deter organisms from attaching in the first reduce the adhesion strength of those that do attach, so that sprese generated by ship movement or ridd mechanical clean (Zwitterionic)

Fig. S4 Photos for A- $\chi$ , Z- $\chi$  and S- $\chi$  coatings after immersed in ASW for 9 months (red arrows indicate defects of the coatings).

#### **Figure S5**

(a) Before Imm	ersion	<b>5</b> mm	(b) After 9 months 5 mm		
A-0 Level 1	Z-0 Level 2	S-0 Level 2	A-0 Level 3	Z-0 **	S-0 Level 4
A-0.125 Level 1	Z-0.125 Level 2	S-0.125 Level 2	A-0.125 Level 2	Z-0.125 **	S-0.125 Level 3
A-0.25 Level 1	Z-0.25 Level 1	S-0.25 Level 1	A-0.25 Level 2	Z-0.25 **	S-0.25 Level 2
A-0.5 Level 1	Z-0.5 Level 1	S-0.5 Level 1	A-0.5 Level 2	Z-0.5 Level 3	S-0.5 Level 2
A-1 Level 1	Z-1 Level 1	S-1 Level 1	A-1 Level 1	Z-1 Level 2	S-1 Level 1

**Fig. S5** Superficial morphology of cross-cut tests for A- $\chi$ , Z- $\chi$  and S- $\chi$  coatings (a) before and (b) after immersed in ASW for 9 months (\*\* indicates that the coatings were disappeared).