

ADVANCED MATERIALS

Supporting Information

for *Adv. Mater.*, DOI: 10.1002/adma.202102542

Chaotic Organic Crystal Phosphorescent Patterns for
Physical Unclonable Functions

*Healin Im, Jinsik Yoon, Jinho Choi, Jinsang Kim,
Seungho Baek, Dong Hyuk Park,* Wook Park,* and
Sunkook Kim**

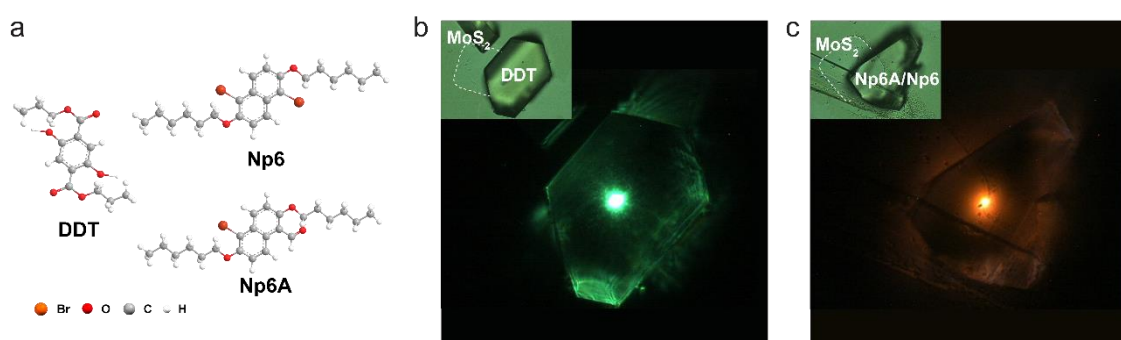
Supporting Information

Chaotic Organic Crystal Phosphorescent Patterns
for Physical Unclonable Functions

Healin Im, Jinsik Yoon, Jinho Choi, Jinsang Kim, Dong Hyuk Park, Wook Park*, and Sunkook Kim**

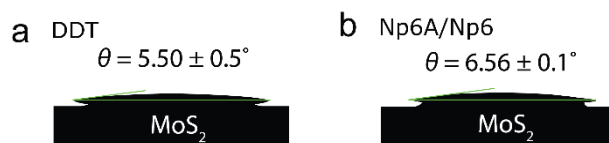
KEYWORDS Physical unclonable functions, organic crystal patterns, MoS₂, security labels

Phosphorescent organic crystals

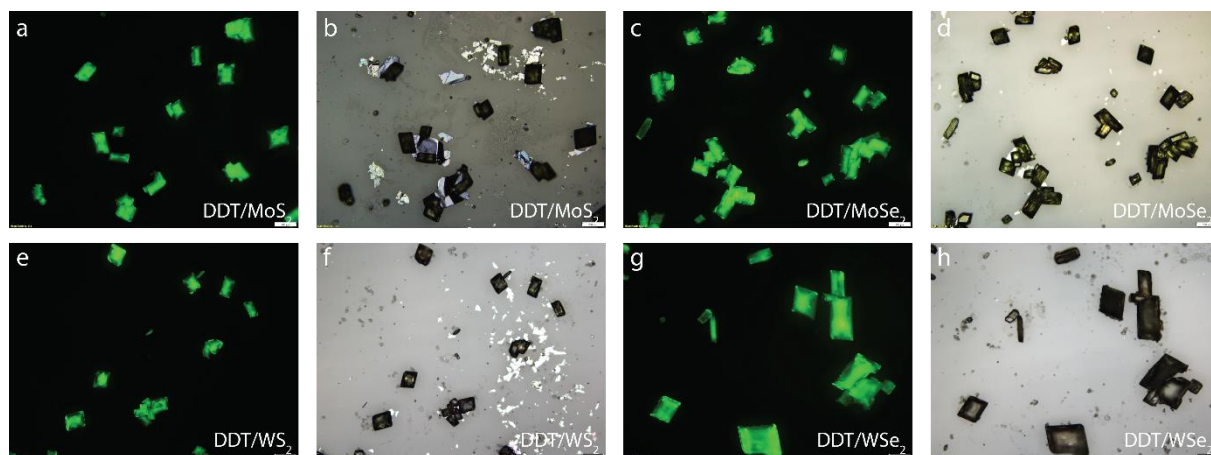


Supporting Figure 1. Phosphorescent organic molecules. a) Molecular structures. Optical images of b) DDT and c) Np6A/Np6 crystals on the MoS₂ seeds under a 405 nm laser irradiation.

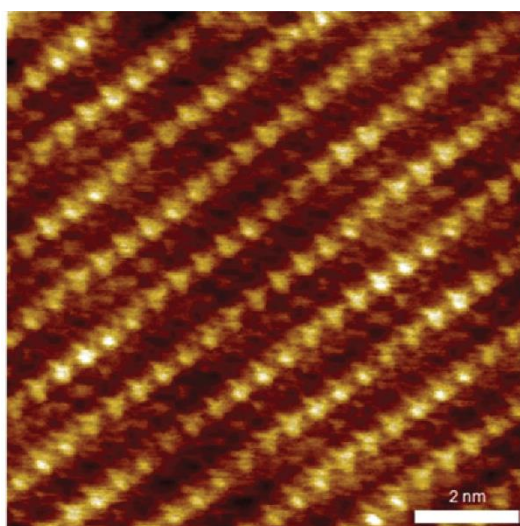
Site-specifically formation of DDT crystals on various 2-dimensional layered materials



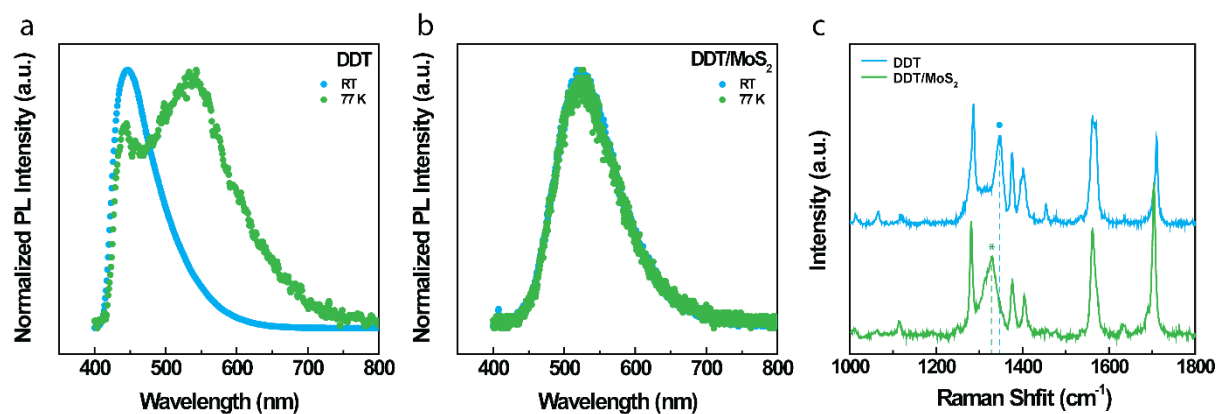
Supporting Figure 2. Solution contact-angle measurements of a) DDT and b) Np6A/Np6 on the MoS₂.



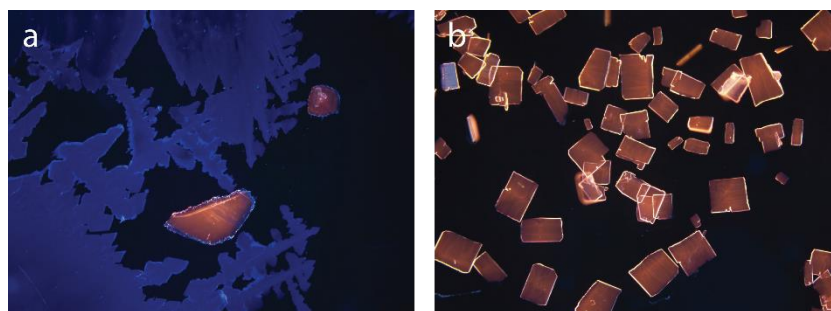
Supporting Figure 3. Preferential crystallization of DDT on 2D materials. CCD and optical images of DDT crystals on a, b) MoS₂, c, d) MoSe₂, e, f) WS₂, and g, h) WSe₂.



Supporting Figure 4. STM image of DDT/graphene.

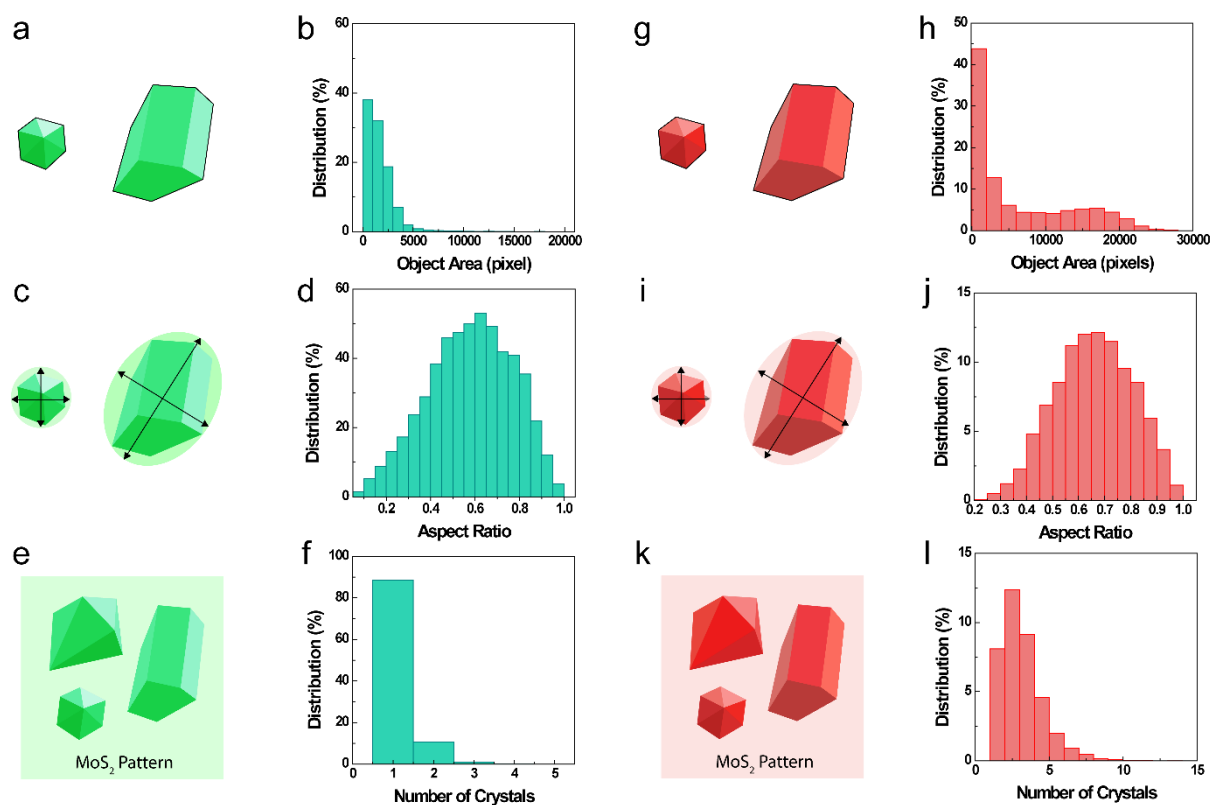
Photophysical features of organic crystals on MoS₂

Supporting Figure 5. Photophysical features of organic crystals on MoS₂. Temperature-dependent PL spectra of a) DDT and b) DDT/MoS₂. c) Raman spectra of DDT and DDT/MoS₂ (• and * mark singlet and triplet states originated from C=O).



Supporting Figure 6. CCD images of Np6A/Np6 crystals on a) SiO₂ and b) MoS₂.

Image analysis of phosphorescent organic crystal patterns



Supporting Figure 7. Characteristics and digitization of a-f) DDT and g-l) Np6A/Np6 crystals. a, b, g, h) Crystal area. c, d, i, j) Aspect ratio. e, f, k, l) The number of crystals per MoS₂ seed.