# Supplementary Information 

# Anion Receptors with Nitrone C-H Hydrogen Bond Donors 

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## S. 1 General methods

All commercially available reagents and solvents were used without purification. ${ }^{1} \mathrm{H}$ NMR (400 MHz and 500 MHz ) and ${ }^{13} \mathrm{C}$ NMR ( 100 MHz and 125 MHz ) were recorded on a Bruker AVIII400 MHz Nanobay and Bruker AVIII 500 MHz at rt ( 298 K ). Chemical shifts $(\delta)$ were referenced to tetramethylsilane (TMS) or residual solvent peaks, chloroform (7.26 ppm for ${ }^{1} \mathrm{H}$ NMR, 77.16 ppm for ${ }^{13} \mathrm{C}$ NMR $)$, acetone- $d_{6}\left(2.05 \mathrm{ppm}\right.$ for ${ }^{1} \mathrm{H}$ NMR, 29.84 ppm for ${ }^{13} \mathrm{C}$ NMR $)$, DMSO- $d_{6}(2.50$ ppm for ${ }^{1} \mathrm{H}$ NMR, 39.52 ppm for ${ }^{13} \mathrm{C}$ NMR), acetonitrile- $d_{3}\left(1.94 \mathrm{ppm}\right.$ for ${ }^{1} \mathrm{H}$ NMR, 1.32 ppm for ${ }^{13} \mathrm{C}$ NMR). High resolution electrospray ionization (ESI) mass spectrometry was performed on Agilent 6230 TOF LC/MS. Column chromatography was performed on the Biotage Isolera One system. Empty flash cartridge housing from Luknova were filled and packed with Silicycle F60 silica gel ( $40-63 \mu \mathrm{~m}, 60 \AA$ ) for column chromatography purifications.

## S. 2 Synthesis and Characterization of Compounds


$2 \mathrm{mmol})$ and rhodium $5 \%$ on carbon ( $\mathrm{Rh} / \mathrm{C}$ ) ( $11 \mathrm{mg}, 0.0054 \mathrm{mmol} \mathrm{Rh}, 0.006$ equivalents) in THF ( 3 mL ) was slowly added hydrazine monohydrate $(0.107 \mathrm{~g}, 2.14 \mathrm{mmol}, 2.4$ equiv.) and stirred at $0{ }^{\circ} \mathrm{C}$ under $\mathrm{N}_{2}$ atmosphere for 1 hour. The reaction was monitored by TLC. The reaction mixture was filtered through Celite to remove the residue of $\mathrm{Rh} / \mathrm{C}$. The filtrate was dried using a rotary evaporator and then high vacuum to provide a yellow-brown solid $(0.107 \mathrm{~g}$ $0.76 \mathrm{mmol}, 86 \%)$ without further purification. ${ }^{1} \mathrm{H}$ NMR ( 400 MHz , Acetone $-d_{6}$ ): $\delta=7.57(\mathrm{~s}, 2 \mathrm{H})$, $7.51(\mathrm{~s}, 2 \mathrm{H}), 6.99(\mathrm{t}, J=8 \mathrm{~Hz}, 1 \mathrm{H}), 6.66(\mathrm{t}, J=2 \mathrm{~Hz}, 1 \mathrm{H}), 6.43(\mathrm{dd}, J=8,2 \mathrm{~Hz}, 2 \mathrm{H}) .{ }^{13} \mathrm{C}$ NMR
(125 MHz, Acetone- $d_{6}$ ): $\delta=153.5,129.3,106.7,99.9$. ESI: $\mathrm{C}_{6} \mathrm{H}_{9} \mathrm{~N}_{2} \mathrm{O}_{2}[\mathrm{M}+\mathrm{H}]^{+}$calcd 141.06585, found 141.06581 .


Dinitrone 3: Dihydroxylamine $2(0.107 \mathrm{~g}, 0.77 \mathrm{mmol})$ and benzaldehyde ( $0.406 \mathrm{~g}, 3.83 \mathrm{mmol}$, 5 equiv) were dissolved with 5 mL ethanol in a vial. The reaction mixture was stirred at room temperature under $\mathrm{N}_{2}$ atmosphere overnight. The milky suspension was generated next day. 10 mL hexane was added to the milky suspension and then sonicated for 15 minutes. The mixture was filtered using a membrane filter and thoroughly washed with hexane $(5 \mathrm{~mL} \times 3)$. The solid mixture was collected and transferred to a vial and dried completely under high vacuum to provide a light yellow solid product ( $90 \mathrm{mg}, 0.28 \mathrm{mmol}, 36 \%$ ). ${ }^{1} \mathrm{H}$ NMR ( 400 MHz, DMSO- $d_{6}$ ): $\delta=8.66(\mathrm{~s}, 2 \mathrm{H}), 8.52-8.50(\mathrm{~m}, 5 \mathrm{H}), 8.09(\mathrm{dd}, J=8,2 \mathrm{~Hz}, 2 \mathrm{H}), 7.74(\mathrm{t}, J=8$, 1.03H), 7.55-7.51 (m, 6H). ${ }^{13} \mathrm{C}$ NMR ( $125 \mathrm{MHz}, \mathrm{DMSO}-d_{6}$ ): $\delta=148.7,134.2,130.9,130.9,129.9$, 129.0, 128.5, 122.8, 115.1. ESI: $\mathrm{C}_{20} \mathrm{H}_{17} \mathrm{~N}_{2} \mathrm{O}_{2}[\mathrm{M}+\mathrm{H}]^{+}$calcd 317.12845, found 317.12842.


3,5-Dinitrobenzyl alcohol (5) was prepared from 3,5-Dinitrobenzoic acid following the published method. ${ }^{2}$ The ${ }^{1} \mathrm{H}$ NMR and ${ }^{13} \mathrm{C}$ NMR spectra matched that of the published results. ${ }^{2}$


Compound 6: A solution of nonanoic acid ( $1.64 \mathrm{~g}, 11.4 \mathrm{mmol}, 1.5$ equiv.) and thionyl chloride ( $5.4 \mathrm{~g}, 45.4 \mathrm{mmol}, 6$ equiv.) in chloroform ( 8 mL ) was stirred at $70{ }^{\circ} \mathrm{C}$ for 6 hours. Chloroform and excess thionyl chloride were removed by distillation to give nonanoyl chloride, which was used in the next step without
further purification. To a solution of compound $5(1.5 \mathrm{~g}, 7.57 \mathrm{mmol})$ and triethyl amine ( 4.2 mL , $30 \mathrm{mmol}, 4$ equiv.) in $\mathrm{DCM}(50 \mathrm{~mL})$ was dropwise added nonanoyl chloride ( 11.4 mmol ) at $0^{\circ} \mathrm{C}$. The reaction was warmed to room temperature and stirred under nitrogen atmosphere for 16 hours. The reaction was quenched with water. The reaction mixture was extracted with DCM ( $3 \times 50$ $\mathrm{mL})$ and the organic phase was washed with brine $(1 \times 50 \mathrm{~mL})$. The organic phase was collected and dried with $\mathrm{MgSO}_{4}$, filtered and dried by rotary evaporation. The crude mixture was purified by column chromatography $\left(\mathrm{SiO}_{2}\right.$, hexane:ethyl acetate $\left.10: 1\right)$ yielding the product as a light yellow solid (2.25 g. $6.66 \mathrm{mmol}, 88 \%) .{ }^{1} \mathrm{H}$ NMR ( 400 MHz CDCl 3 ): $\delta=9.00(\mathrm{t}, J=2 \mathrm{~Hz}, 1 \mathrm{H}), 8.54(\mathrm{~d}, J$ $=2 \mathrm{~Hz}, 2 \mathrm{H}), 5.30(\mathrm{~s}, 2 \mathrm{H}), 2.44(\mathrm{t}, J=8 \mathrm{~Hz}, 2 \mathrm{H}), 1.71-1.64(\mathrm{~m}, 2 \mathrm{H}), 1.35-1.27(\mathrm{~m}, 10 \mathrm{H}), 0.87(\mathrm{t}, J$ $=8,3 \mathrm{H}) .{ }^{13} \mathrm{C}$ NMR $\left(125 \mathrm{MHz}, \mathrm{CDCl}_{3}\right): \delta=173.2,148.7,141.0,127.8,118.4 .63 .7,34.1,31.8$, 29.25, 29.18, 29.16, 24.9, 22.7, 14.1. ESI: $\mathrm{C}_{16} \mathrm{H}_{22} \mathrm{~N}_{2} \mathrm{O}_{6}[\mathrm{M}]^{-}$calcd 338.14834, found 338.14695.


Dihydroxylamine 7: To a mixture of compound $6(0.3 \mathrm{~g}, 0.89 \mathrm{mmol})$ and rhodium $5 \%$ on carbon $(\mathrm{Rh} / \mathrm{C})(18 \mathrm{mg}, 0.0089 \mathrm{mmol}, 0.01$ equiv. $)$ in THF ( 3 mL ) was slowly added hydrazine monohydrate $(0.11 \mathrm{~mL}$, $2.2 \mathrm{mmol}, 2.5$ equiv.) and stirred at $0^{\circ} \mathrm{C}$ under nitrogen atmosphere for 1 hour. The reaction was monitored by TLC. The reaction mixture was filtered through Celite. The filtrate was dried using a rotary evaporator, followed by high vacuum to provide 7 as a yellow solid ( $0.26 \mathrm{~g} 0.84 \mathrm{mmol}, 94 \%$ ). ${ }^{1} \mathrm{H}$ NMR ( 400 MHz , Acetone- $d_{6}$ ): $\delta=7.63(\mathrm{~s}, 2 \mathrm{H}), 7.59(\mathrm{~s}, 2 \mathrm{H})$, $6.61(\mathrm{~s}, 1 \mathrm{H}), 6.45(\mathrm{~s}, 2 \mathrm{H}), 4.97(\mathrm{~s}, 2 \mathrm{H}), 2.33(\mathrm{t}, J=8 \mathrm{~Hz}, 2 \mathrm{H}), 1.64-1.58(\mathrm{~m}, 2 \mathrm{H}), 1.34-1.27(\mathrm{~m}$, $10 \mathrm{H}), 0.87(\mathrm{t}, J=4 \mathrm{~Hz}, 3 \mathrm{H}) .{ }^{13} \mathrm{C}$ NMR ( 125 MHz Acetone $-d_{6}$ ): $\delta=173.6,153.5,138.0,106.1$, 99.3, 66.7, 34.6, 32.5, 29.9, 29.8, 29.8, 25.6, 23.2, 14.3. ESI: $\mathrm{C}_{16} \mathrm{H}_{26} \mathrm{~N}_{2} \mathrm{O}_{4}[\mathrm{M}+\mathrm{H}]^{+}$calcd 311.19653, found 311.19631 .


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Dinitrone 8: Dihydroxylamine $7(0.088 \mathrm{~g}, 0.28 \mathrm{mmol})$ and benzaldehyde ( $0.14 \mathrm{~mL}, 1.42 \mathrm{mmol}, 5$ equiv.) were dissolved with 2 mL ethanol in a vial. The reaction mixture was stirred at room temperature under nitrogen atmosphere overnight. The solvent was removed by rotary evaporation. The crude mixture was purified by column chromatography $\left(\mathrm{SiO}_{2}\right.$, hexane:ethyl acetate $\left.2.5: 1\right)$ yielding the product as blown sticky oil (76 mg. $0.16 \mathrm{mmol}, 57 \%) .{ }^{1} \mathrm{H}$ NMR ( 400 MHz Acetone $-d_{6}$ ): $\delta=8.56-8.54(\mathrm{~m}, 4 \mathrm{H}), 8.52(\mathrm{~s}, 2 \mathrm{H})$, $8.43(\mathrm{~s}, 1 \mathrm{H}), 8.10(\mathrm{~s}, 2 \mathrm{H}), 7.51-7.50(\mathrm{~m}, 6 \mathrm{H}), 5.29(\mathrm{~s}, 2 \mathrm{H}), 2.43(\mathrm{t}, J=8 \mathrm{~Hz}, 2 \mathrm{H}), 1.67-1.61(\mathrm{~m}$, $2 \mathrm{H}), 1.35-1.25(\mathrm{~m}, 10 \mathrm{H}), 0.85(\mathrm{t}, J=4 \mathrm{~Hz}, 3.00 \mathrm{H}).) .{ }^{13} \mathrm{C}$ NMR ( 125 MHz Acetone- $d_{6}$ ): $\delta=173.5$, $150.4,140.3,134.7,132.2,131.6,129.9,129.3,122.7,115.3,65.1,34.5,32.5,30.0$ (overlap with the solvent peak), 29.9, 29.8, 25.6, 23.3, 14.3. ESI: $\mathrm{C}_{20} \mathrm{H}_{34} \mathrm{~N}_{2} \mathrm{O}_{4}[\mathrm{M}+\mathrm{H}]^{+}$calcd 487.25913, found 487.25850.


Dicyanostilbene (9) was prepared from the condensation between $p$-Anisaldehyde and 1,3-Phenylenediacetonitrile following the published method. ${ }^{3}$ The ${ }^{1} \mathrm{H}$ NMR and ${ }^{13} \mathrm{C}$ NMR spectra matched that of the published results. ${ }^{3}$

## S. 3 NMR Spectra of Compounds



Figure S1. ${ }^{1} \mathrm{H}$ NMR spectrum of $2\left(400 \mathrm{MHz}\right.$, Acetone $\left.-d_{6}\right)$.




Figure $\boldsymbol{S} \mathbf{2} .{ }^{13} \mathrm{C}$ NMR spectrum of $\mathbf{2}\left(125 \mathrm{MHz}\right.$, Acetone $\left.-d_{6}\right)$.


Figure S3. ${ }^{1} \mathrm{H}$ NMR spectrum of $\mathbf{3}\left(400 \mathrm{MHz}, \mathrm{DMSO}-d_{6}\right)$.


Figure S4. ${ }^{13} \mathrm{C}$ NMR spectrum of $\mathbf{3}\left(125 \mathrm{MHz}\right.$, DMSO- $\left.d_{6}\right)$.


Figure S5. ${ }^{1} \mathrm{H}$ NMR spectrum of $\mathbf{6}\left(400 \mathrm{MHz}, \mathrm{CDCl}_{3}\right)$.




Figure S6. ${ }^{13} \mathrm{C}$ NMR spectrum of $6\left(125 \mathrm{MHz}, \mathrm{CDCl}_{3}\right)$.




Figure S7. ${ }^{1} \mathrm{H}$ NMR spectrum of 7 ( 400 MHz , Acetone $-d_{6}$ ).
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Figure S8. ${ }^{13} \mathrm{C}$ NMR spectrum of $7\left(125 \mathrm{MHz}\right.$, Acetone- $\left.d_{6}\right)$.


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Figure S9. ${ }^{1} \mathrm{H}$ NMR spectrum of $8\left(400 \mathrm{MHz}\right.$, Acetone- $\left.d_{6}\right)$.
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Figure S10. ${ }^{13} \mathrm{C}$ NMR spectrum of $\mathbf{8}\left(125 \mathrm{MHz}\right.$, Acetone- $\left.d_{6}\right)$.

## S. 4 Determining Anion Association Constant Using ${ }^{1}$ H NMR Titration

A solution of dinitrone $\mathbf{8}$ in acetone- $d_{6}(5 \mathrm{mM}, 0.5 \mathrm{~mL})$ was loaded into an NMR tube capped with silicone/PTFE septum. Increasing equivalents of tetrabutylammonium chloride (TBACI), tetrabutylammonium bromide (TBABr) and tetrabutylammonium iodide (TBAI) were added as a concentrated solution ( 250 mM ). Spectra were recorded after each addition.


Figure S11. ${ }^{1} \mathrm{H}$ NMR titration of dinitrone $\mathbf{8}$ with TBACl ( 5 mM Acetone- $d_{6}, 298 \mathrm{~K}$ )


| Parameters |  |  |  |
| :--- | :--- | :--- | :--- |
| Parameter <br> (bounds) | Optimised | Error | Initial |
| $\mathrm{K}(0 \rightarrow \infty)$ | $107.16 \mathrm{M}^{-1}$ | $\pm 1.9341$ | 100.00 |
|  |  | $\%$ | $\mathrm{M}^{-1}$ |



Figure S12. Result of data fitting of dinitrone $\mathbf{8}$ for proton $\mathrm{H}^{\mathrm{a}}$ and $\mathrm{H}^{\mathrm{c}}$ using online Bindfit platform


Figure S13. ${ }^{1} \mathrm{H}$ NMR titration of dinitrone $\mathbf{8}\left(5 \mathrm{mM}\right.$ Acetone- $\left.d_{6}, 298 \mathrm{~K}\right)$ with TBABr.


Figure S14. Result of data fitting of dinitrone $\mathbf{8}$ for proton $\mathrm{H}^{\mathrm{a}}$ and $\mathrm{H}^{\mathrm{c}}$ using online Bindfit platform


Figure S15. ${ }^{1} \mathrm{H}$ NMR titration of dinitrone $\mathbf{8}$ with TBAI ( 5 mM Acetone- $d_{6}, 298 \mathrm{~K}$ )



Figure S16. Result of data fitting of dinitrone $\mathbf{8}$ for proton $\mathrm{H}^{\mathrm{a}}, \mathrm{H}^{\mathrm{b}}$ and $\mathrm{H}^{\mathrm{c}}$ using online Bindfit platform.


Figure S17. ${ }^{1} \mathrm{H}$ NMR titration of dinitrone $\mathbf{8}$ with $\mathrm{TBAH}_{2} \mathrm{PO}_{4}(5 \mathrm{mM} \mathrm{CD} 3 \mathrm{CN}, 298 \mathrm{~K})$.


Figure S18. Result of data fitting of dinitrone $\mathbf{8}$ for proton $\mathrm{H}^{\mathrm{a}}$ using online Bindfit platform.


Figure S19. ${ }^{1} \mathrm{H}$ NMR titration of dinitrone $\mathbf{8}$ with $\mathrm{TBAHSO}_{4}\left(5 \mathrm{mM}\right.$ Acetone- $\left.d_{6}, 298 \mathrm{~K}\right)$. Dinitrone $\mathbf{8}$ started to decompose when 10 equiv. of $\mathrm{TBAHSO}_{4}$ is added.

To compare the binding constant of dinitrone $\mathbf{8}$ with dicyanostilbene $\mathbf{9}$, we titrated dicyanostilbene 9 with TBACl in acetone ( 0.6 mM in acetone $-d_{6}$ ) and determined its binding constant.


Figure S20. ${ }^{1} \mathrm{H}$ NMR titration of dicyanostibene $\mathbf{9}$ with $\mathrm{TBACl}\left(0.6 \mathrm{mM}\right.$ acetone- $\left.d_{6}, 298 \mathrm{~K}\right)$.


| Parameters |  |  |  |
| :--- | :--- | :--- | :--- |
| Parameter <br> (bounds) | Optimised | Error | Initial |
| $\mathbf{K}(0 \rightarrow \infty)$ | $29.75 \mathrm{M}^{-1}$ | $\pm 0.6227$ <br> $\%$ | 100.00 <br> $\mathrm{M}^{-1}$ |



Figure S21. Result of data fitting of dicyanostilbene 9 for proton $\mathrm{H}^{\mathrm{a}}$ using online Bindfit platform.

## S. 5 Computational Studies of Dinitrone 3

All structures were minimized using DFT B3LYP 6-31G* in Spartan '18 (version1.1.0). All energies are given in kcal/mol. "Conformer Distribution" method (shown below) was used to identify viable conformations I, II, and III.


## Conformation I



Figure S22. Conformation I, Energies $=-647328.30 \mathrm{kcal} / \mathrm{mol}$

|  | $\mathbf{X}$ | $\mathbf{Y}$ | $\mathbf{Z}$ |
| :---: | :---: | :---: | :---: |
| H | 0.906834 | -0.266087 | -4.474763 |
| C | 0.676677 | -0.287942 | -3.413677 |
| C | 0.130458 | -0.347621 | -0.674416 |
| C | 0.402469 | -1.503136 | -2.792658 |
| C | 0.673971 | 0.903339 | -2.685802 |
| C | 0.377278 | 0.861284 | -1.323378 |
| C | 0.154237 | -1.523177 | -1.418643 |
| H | 0.380938 | -2.437960 | -3.338495 |
| H | 0.922376 | 1.841117 | -3.170503 |


| H | -0.089921 | -0.324226 | 0.384925 |
| :---: | :---: | :---: | :---: |
| N | -0.118961 | -2.822715 | -0.814603 |
| C | 0.233383 | -3.044801 | 0.441315 |
| H | 0.754005 | -2.230124 | 0.925336 |
| C | 0.010192 | -4.255234 | 1.199768 |
| C | -0.330910 | -6.517943 | 2.840732 |
| C | -0.653039 | -5.402324 | 0.710227 |
| C | 0.495918 | -4.272301 | 2.526967 |
| C | 0.328551 | -5.388707 | 3.336047 |
| C | -0.817855 | -6.514411 | 1.532472 |
| H | -1.024812 | -5.396393 | -0.3052 |
| H | 1.007745 | -3.395617 | 2.916885 |
| H | 0.710017 | -5.379680 | 4.3542 |
| H | -1.331307 | -7.389622 | 1.143829 |
| H | -0.462713 | -7.392715 | 3.471906 |
| O | -0.669293 | -3.681099 | -1.592605 |
| N | 0.333897 | 2.061179 | -0.496132 |
| C | -0.089510 | 3.198570 | -1.022776 |
| H | -0.426203 | 3.131706 | -2.048828 |
| C | -0.164222 | 4.483224 | -0.363186 |
| C | -0.375545 | 7.066978 | 0.738611 |
| C | 0.222683 | 4.726635 | 0.974021 |
| C | -0.660388 | 5.562664 | -1.127478 |
| C | -0.764401 | 6.837058 | -0.584372 |
| C | 0.115874 | 6.009078 | 1.507360 |
| H | 0.600102 | 3.904379 | 1.564829 |
| H | -0.963518 | 5.389760 | -2.157220 |
| H | -1.148398 | 7.653298 | -1.191500 |


| H | 0.418759 | 6.182020 | 2.536630 |
| :--- | :---: | :---: | :---: |
| H | -0.457385 | 8.063044 | 1.165269 |
| O | 0.692017 | 1.898502 | 0.724844 |

Conformation II


Figure S23. Conformation II, Energy $=-647327.29 \mathrm{kcal} / \mathrm{mol}$

|  | $\mathbf{X}$ | $\mathbf{Y}$ | $\mathbf{Z}$ |
| :---: | :---: | :---: | :---: |
| H | -5.185922 | -0.000358 | -0.486968 |
| C | -4.117056 | -0.000181 | -0.293904 |
| C | -1.370183 | 0.000218 | 0.225339 |
| C | -3.440383 | -1.211635 | -0.166999 |
| C | -3.440485 | 1.211490 | -0.166068 |
| C | -2.067500 | 1.199699 | 0.077460 |
| C | -2.067381 | -1.199576 | 0.076769 |
| H | -3.948465 | -2.165923 | -0.232304 |
| H | -3.948720 | 2.165610 | -0.230478 |
| H | -0.326689 | 0.000651 | 0.515886 |
| N | -1.407647 | -2.490477 | 0.234398 |
| C | -0.155434 | -2.635728 | -0.170087 |
| H | 0.277967 | -1.766673 | -0.647122 |


| C | 0.656456 | -3.826925 | -0.058626 |
| :---: | :---: | :---: | :---: |
| C | 2.396255 | -6.038539 | 0.073843 |
| C | 0.233469 | $-5.037262$ | 0.534470 |
| C | 1.967406 | -3.756286 | -0.582926 |
| C | 2.825070 | -4.847033 | -0.519021 |
| C | 1.104311 | -6.122738 | 0.596810 |
| H | -0.769062 | -5.099500 | 0.933665 |
| H | 2.307409 | -2.830771 | -1.043055 |
| H | 3.827720 | -4.770532 | -0.930816 |
| H | 0.766178 | -7.046920 | 1.057811 |
| H | 3.064854 | -6.893546 | 0.125530 |
| O | -2.133700 | -3.418741 | 0.736778 |
| N | -1.407778 | 2.490300 | 0.236339 |
| C | -0.157267 | 2.636911 | -0.173062 |
| H | 0.274421 | 1.769032 | -0.654532 |
| C | 0.655123 | 3.827661 | -0.060778 |
| C | 2.395931 | 6.038209 | 0.074309 |
| C | 0.232005 | 5.038156 | 0.531434 |
| C | 1.966847 | 3.756055 | -0.582730 |
| C | 2.825329 | 4.846043 | -0.517149 |
| C | 1.103036 | 6.123494 | 0.594596 |
| H | -0.770760 | 5.100498 | 0.929480 |
| H | 2.307134 | 2.830035 | -1.041273 |
| H | 3.829325 | 4.768200 | -0.925856 |
| H | 0.764806 | 7.048117 | 1.055292 |
| H | 3.065037 | 6.892767 | 0.127413 |
| O | -2.131660 | 3.416197 | 0.746132 |

## Conformation III



Figure S24. Conformation III, Energy $=-647326.82 \mathrm{kcal} / \mathrm{mol}$

|  | $\mathbf{X}$ | $\mathbf{Y}$ | $\mathbf{Z}$ |
| :---: | :---: | :---: | :---: |
| H | -3.364851 | 0.000054 | -2.048724 |
| C | -2.496936 | 0.000026 | -1.396190 |
| C | -0.336144 | -0.000080 | 0.378779 |
| C | -1.957926 | 1.211555 | -0.965706 |
| C | -1.958183 | -1.211561 | -0.965405 |
| C | -0.868604 | -1.196973 | -0.090682 |
| C | -0.868330 | 1.196870 | -0.090983 |
| H | -2.410663 | 2.148169 | -1.272142 |
| H | -2.411095 | -2.148150 | -1.271656 |
| H | 0.465975 | -0.000084 | 1.104276 |
| N | -0.270025 | 2.427832 | 0.416221 |
| C | -0.222844 | 3.494765 | -0.366214 |
| H | -0.595807 | 3.344929 | -1.370473 |
| C | 0.284035 | 4.802260 | -0.014477 |
| C | 1.197796 | 7.419343 | 0.484825 |
| C | 0.806063 | 5.149952 | 1.251267 |
| C | 0.237085 | 5.794925 | -1.019635 |
| C | 0.688019 | 7.085525 | -0.773792 |
| C | 1.252174 | 6.448520 | 1.486816 |
| H | 0.849428 | 4.394193 | 2.022767 |
|  |  |  |  |


| H | -0.160611 | 5.540476 | -1.999789 |
| :--- | :--- | :--- | :--- |
| H | 0.642479 | 7.832773 | -1.561530 |
| H | 1.648656 | 6.702995 | 2.466239 |
| H | 1.550457 | 8.428412 | 0.680323 |
| O | 0.197534 | 2.361307 | 1.605758 |
| N | -0.270579 | -2.428000 | 0.416688 |
| C | -0.222982 | -3.494766 | -0.365912 |
| H | -0.595550 | -3.344724 | -1.370216 |
| C | 0.284045 | -4.802226 | -0.014316 |
| C | 1.198514 | -7.419024 | 0.484396 |
| C | 0.805171 | -5.150223 | 1.251656 |
| C | 0.237778 | -5.794569 | -1.019798 |
| C | 0.689004 | -7.085100 | -0.774264 |
| C | 1.251723 | -6.448657 | 1.486927 |
| H | 0.846746 | -4.395033 | 2.023897 |
| H | -0.159757 | -5.539936 | -1.999960 |
| H | 0.643651 | -7.832247 | -1.562033 |
| H | 1.646665 | -6.703898 | 2.466842 |
| H | 1.551401 | -8.428034 | 0.679748 |
| O | 0.196488 | -2.361594 | 1.606469 |
|  |  |  |  |

Dinitrone $3 \cdot \mathrm{Cl}^{-}$complex


Figure S25. Dinitrone 3 $\cdot \mathrm{Cl}^{-}$complex, Energy $=-936176.60 \mathrm{kcal} / \mathrm{mol}$

|  | $\mathbf{X}$ | $\mathbf{Y}$ | $\mathbf{Z}$ |
| :--- | :---: | :---: | :---: |
| H | 5.167029 | -0.000000 | 1.097694 |
| C | 4.117983 | -0.000000 | 0.812621 |
| C | 1.418605 | 0.000000 | 0.062876 |
| C | 3.454473 | 1.210064 | 0.627866 |
| C | 3.454473 | -1.210064 | 0.627866 |
| C | 2.106333 | -1.199273 | 0.265296 |
| C | 2.106333 | 1.199274 | 0.265296 |
| H | 3.947160 | 2.167065 | 0.741252 |
| H | 3.947160 | -2.167065 | 0.741252 |
| H | 0.376036 | 0.000000 | -0.241370 |
| N | 1.474493 | 2.503752 | 0.068955 |
| C | 0.159892 | 2.613713 | 0.132158 |
| H | -0.406943 | 1.711501 | 0.353528 |
| O | 2.289840 | 3.483481 | -0.136359 |
| C | -0.602924 | 3.828131 | -0.072250 |
| C | -2.296297 | 6.047705 | -0.435324 |
| C | -0.061453 | 5.107401 | -0.329104 |
| C | -2.008846 | 3.684027 | -0.003729 |
| C | -2.840363 | 4.783968 | -0.183351 |
| C | -0.909571 | 6.199044 | -0.507358 |
| H | 1.013110 | 5.213840 | -0.382941 |
| H | -2.421886 | 2.692922 | 0.180458 |
| H | -3.918771 | 4.654044 | -0.129302 |
| H | -0.480766 | 7.179628 | -0.704430 |
| H | -2.948659 | 6.907210 | -0.575834 |
| N | 1.474493 | -2.503752 | 0.068956 |
|  | 0.159892 | -2.613713 | 0.132157 |
| H |  |  |  |


| H | -0.406943 | -1.711501 | 0.353527 |
| :--- | :--- | :--- | :--- |
| O | 2.289840 | -3.483481 | -0.136358 |
| C | -0.602924 | -3.828131 | -0.072250 |
| C | -2.296297 | -6.047705 | -0.435324 |
| C | -0.061453 | -5.107401 | -0.329104 |
| C | -2.008846 | -3.684027 | -0.003729 |
| C | -2.840363 | -4.783969 | -0.183351 |
| C | -0.909571 | -6.199044 | -0.507359 |
| H | 1.013110 | -5.213840 | -0.382942 |
| H | -2.421886 | -2.692923 | 0.180459 |
| H | -3.918771 | -4.654044 | -0.129301 |
| H | -0.480766 | -7.179628 | -0.704430 |
| H | -2.948659 | -6.907210 | -0.575834 |
| Cl | -2.177298 | 0.000000 | 0.449115 |

## S. 6 X-ray Crystallographic Analysis of Dinitrone 3

Single crystals suitable for X-ray crystallography were prepared by slow diffusion of $n$-pentane into a solution of $\mathbf{3}$ in acetone. The crystal was placed MiTeGen pins, coated in oil. The X-ray intensity data collection was carried out on a Bruker APEXII DUO CCD area detector using graphite-monochromated Mo-K $\alpha$ radiation $(\lambda=0.71073 \AA)$ at 90.0 K. CCDC 2201970 contain the supplementary crystallographic data for this paper.

## Crystal data of dinitrone 3

| $\mathrm{C}_{20} \mathrm{H}_{16} \mathrm{~N}_{2} \mathrm{O}_{2}$ | $D_{\mathrm{x}}=1.397 \mathrm{Mg} \mathrm{m}$ |
| :--- | :--- |
| $M_{r}=316.35$ | Mo $K \alpha$ radiation, $\lambda=0.71073 \AA$ |
| Tetragonal, $P 4_{1}$ | Cell parameters from 9912 reflections |
| $a=5.3375(6) \AA$ | $\theta=3.1-28.1^{\circ}$ |
| $c=52.802(9) \AA$ | $\mu=0.09 \mathrm{~mm}^{-1}$ |
| $V=1504.3(4) \AA^{3}$ | $T=90 \mathrm{~K}$ |
| $Z=4$ | Triangular, colourless |
| $F(000)=664$ | $0.33 \times 0.17 \times 0.17 \mathrm{~mm}$ |

## Data collection

| Bruker Kappa APEX-II DUO <br> diffractometer | 3562 independent reflections |
| :--- | :--- |
| Radiation source: fine-focus sealed tube | 3508 reflections with $I>2 \sigma(I)$ |
| TRIUMPH curved graphite monochromator | $R_{\text {int }}=0.062$ |
| $\phi$ and $\omega$ scans | $\theta_{\max }=30.2^{\circ}, \theta_{\min }=1.2^{\circ}$ |
| Absorption correction: multi-scan <br> $S A D A B S$ <br> (Krause et al., 2015) | $h=-7-7$ |
| $T_{\min }=0.921, T_{\max }=0.985$ | $k=-7-7$ |
| 33370 measured reflections | $l=-68-67$ |

## Refinement

| Refinement on $F^{2}$ | Hydrogen site location: inferred from <br> neighbouring sites |
| :--- | :--- |
| Least-squares matrix: full | H-atom parameters constrained |
| $R\left[F^{2}>2 \sigma\left(F^{2}\right)\right]=0.048$ | $w=1 /\left[\sigma^{2}\left(F_{0}^{2}\right)+(0.038 P)^{2}+1.4807 P\right]$ |


|  | where $P=\left(F_{\mathrm{o}}{ }^{2}+2 F_{\mathrm{c}}{ }^{2}\right) / 3$ |
| :--- | :--- |
| $w R\left(F^{2}\right)=0.119$ | $(\Delta / \sigma)_{\max }<0.001$ |
| $S=1.16$ | $\Delta \rho_{\max }=0.34 \mathrm{e} \AA^{-3}$ |
| 3562 reflections | $\Delta \rho_{\min }=-0.41 \mathrm{e} \AA^{-3}$ |
| 218 parameters | Absolute structure: Flack x determined using <br> 1632 quotients [(I +$)-(\mathrm{I}-)] /[(\mathrm{I}+)+(\mathrm{I}-)]$ (Parsons, <br> Flack and Wagner, Acta Cryst. B69 (2013) 249- <br> $259)$. |
| 1 restraint | Absolute structure parameter: 0.2 (4) |

Refinement. Refined as a 2-component twin.


Figure S26. X-ray crystal structure of dinitrone 3. Thermal ellipsoids at the $50 \%$ probability level.


Fi
gure $\boldsymbol{S} 27$. Packing structure of $\mathbf{3}$ viewed along the a-axis.


Figure S28. Packing structure of $\mathbf{3}$ viewed along the b-axis.


Figure S29. Packing structure of $\mathbf{3}$ viewed along the c-axis.

## S. 6 References

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