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### Cis-trans isomerism in single molecule electronic devices

Tinsae Alem

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# Cis-trans isomerism in single molecule electronic devices

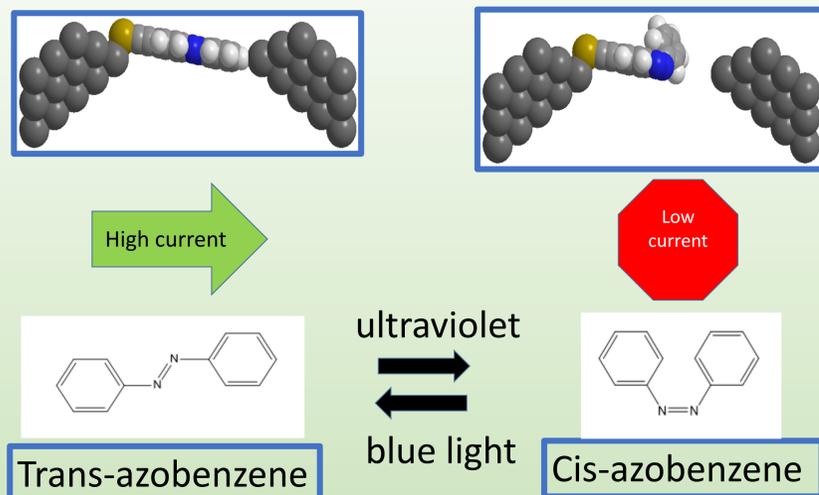
Tinsae Alem and Dr. Benjamin Topham  
Longwood University Department of Chemistry and Physics

## Abstract

We investigated the switching properties of cis-trans isomers of azobenzene for single molecule electronics. Although the cis-trans isomerization leads to structural changes within the molecule, the current flow is found to depend mainly on the relative position of the electrodes. The on/off ratio was determined to measure the performance of these isomers as switches. Different cis-trans isomers were studied to compare results.

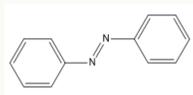
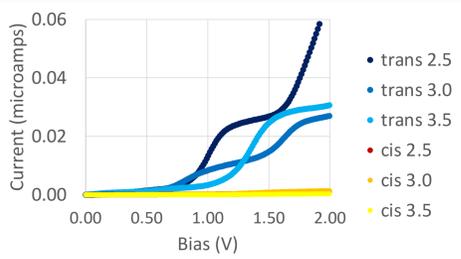
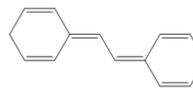
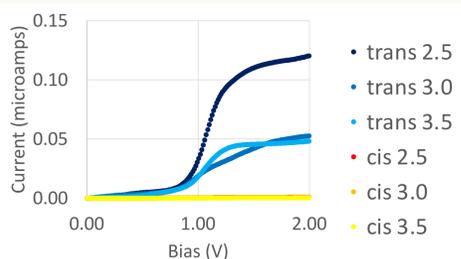
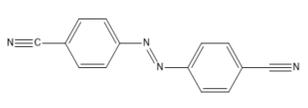
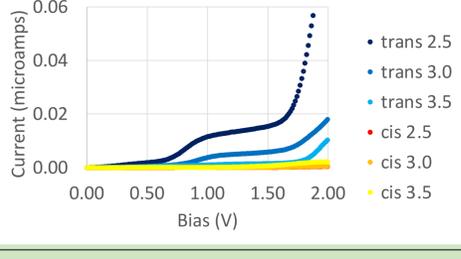
## Molecular electronics

Molecular electronics is a field that creates electron devices such as wires, transistors, rectifiers, and switches, out of single molecules to make smaller devices. Those smaller molecular electronics devices have advantages of speed and higher power. The measurement and the control of the current flow is one of the main goals of this field.



## Cis-Trans photoswitch

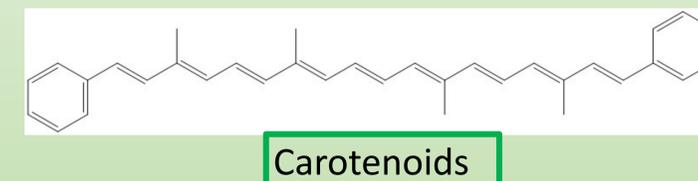
A cis-trans photoswitch switches from cis to trans by using light activation. The wavelength of switching trans to cis is about 300 to 400 nm by using UV light. The cis form can be converted to trans by using visible illumination at a higher 400 nm. Azobenzene isomerize can be a good example of a photoswitch. The trans form extends to gold electrodes on both sides of the junction while the cis form does not connect with gold electrodes.

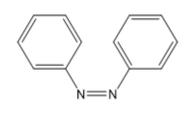
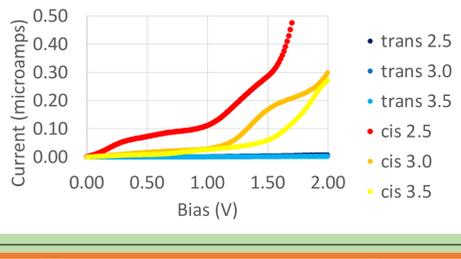
	On/off ratio (trans/cis)	
	78 24 103	
	82 63 104	
	200 49 9.1	

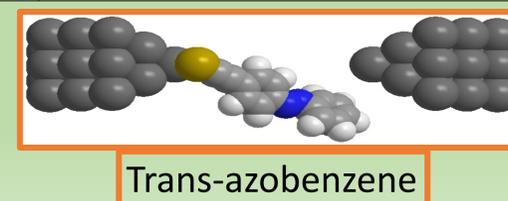
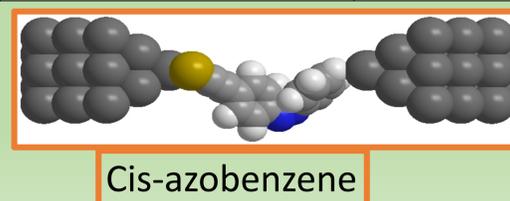
## Device performance

The trans form of the three molecules investigated has more current, leading to large rectification ratios ("on" current divided by "off" current). The trans was connected to gold while the cis wasn't connected to gold electrodes, which leads it to have a big difference of current flow in the trans and cis version.

The cis form had more current compared to the trans version when the cis is closer to the gold compared to the trans. This demonstrates that any molecule that is closer to the gold has a higher current. The current flow increases the more the molecule gets close to the gold.



	On/off ratio (cis/trans)	
	90 30 56	



## Future work

We are looking forward to investigating more about the switching properties of cis-trans isomers with different molecules. Carotenoids are also good photoswitch candidates. The molecule has multiple positions that can isomerize. It would be interesting to see how this affects the photoswitch properties.