



Neoprene Bend Sensor IMPROVED

by [Plusea](#) on April 23, 2009

Table of Contents

Neoprene Bend Sensor IMPROVED	1
Intro: Neoprene Bend Sensor IMPROVED	2
Step 1: Materials and Tools	3
Step 2: Stencil	3
Step 3: Ironing	4
Step 4: Sewing	5
Step 5: Closing the sensor	7
Step 6: Sheep's demo	9
Related Instructables	10
Comments	10

Intro: Neoprene Bend Sensor IMPROVED

Better results and slimmer design, this Instructable improves on the previously posted Fabric Bend Sensor.

Previous Instructable >> [Fabric Bend Sensor](#)

Using neoprene, Velostat, conductive thread and stretch conductive fabric to sew your own fabric bend sensor. The sensor actually reacts (decreases in resistance) to pressure, not specifically to bend. But because it is sandwiched between two layers of neoprene, pressure is exerted while bending. Allowing one to measure bend (angle) via pressure.

To make the sensor fully fabric one can use EeonTex conductive textile (www.eeonyx.com) instead of the plastic Velostat. Eeonyx normally only manufacture and sells its coated fabrics in minimum amounts of 100yds, but 7x10 inch (17.8x25.4 cm) samples are available free of charge and larger samples of 1 to 5 yards for a minimum fee per yard.

VIDEO

To prove the competitiveness of this sensor vs. a commercial bend sensor I made a short video in which Sheep demonstrates their *similarities*.



Step 1: Materials and Tools

The materials used for the sensor are basically cheap and off-the-shelf. There are other places that sell conductive fabrics and Velostat, but LessEMF is a convenient option for both, especially for shipping within North America.

Velostat is the brand name for the plastic bags in which sensitive electronic components are packaged. Also called anti-static, ex-static, carbon based plastic& (So you can also cut up one of these black plastic bags. But caution! Not all of them work!)

- Neoprene 1.5 mm thick HS quality from www.sedochemicals.com
- Velostat by 3M from <http://www.lessemf.com/plastic.html>
- Conductive thread from <http://www.lessemf.com/fabric.html>
- Stretch conductive fabric from <http://www.lessemf.com/fabric.html>
- Fusible interfacing from local fabric store
- Regular sewing thread from local fabric store

TOOLS:

- Pen and paper
- Fabric scissors
- Iron
- Sewing needle
- Possibly pliers for pulling needle through neoprene

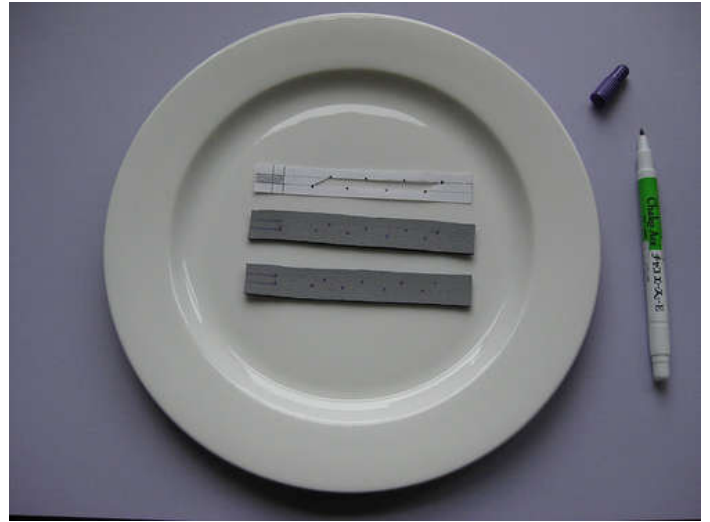
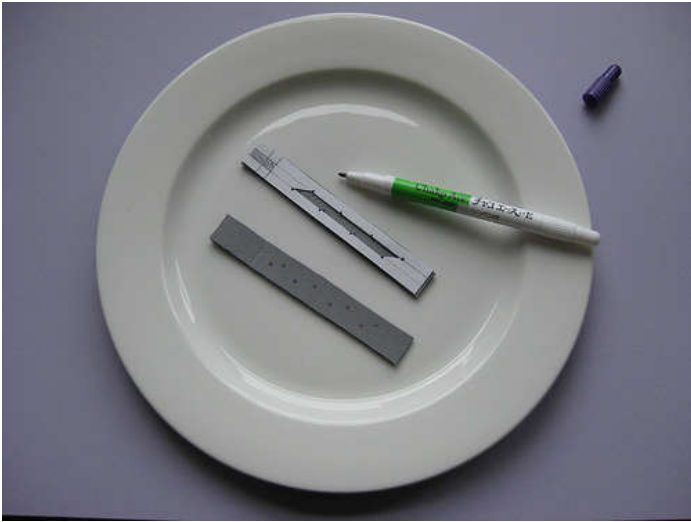


Step 2: Stencil

Print out a copy of the Neoprene Bend Sensor Improved PDF and cut out the stencils for the neoprene, Velostat and stretch conductive fabric tabs. Trace it twice onto your piece of neoprene and cut these out. Now mark the inner stitches and placement of conductive fabric patch onto these cutouts. Caution! The tracing should be identical and NOT mirrored.

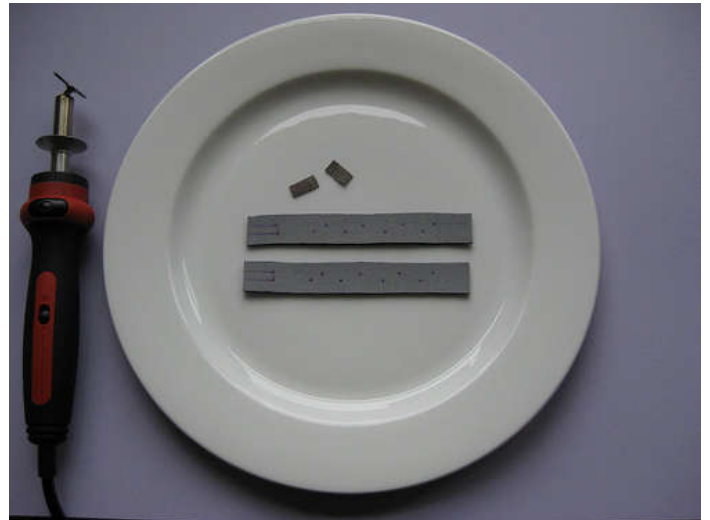
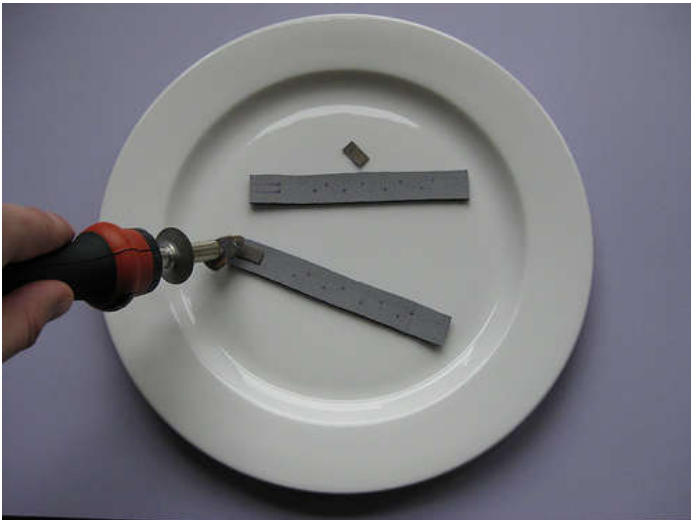
Download Stencil PDF >> <http://kobakant.at/downloads/stencils/neoprene-BS-improved.pdf>





Step 3: Ironing

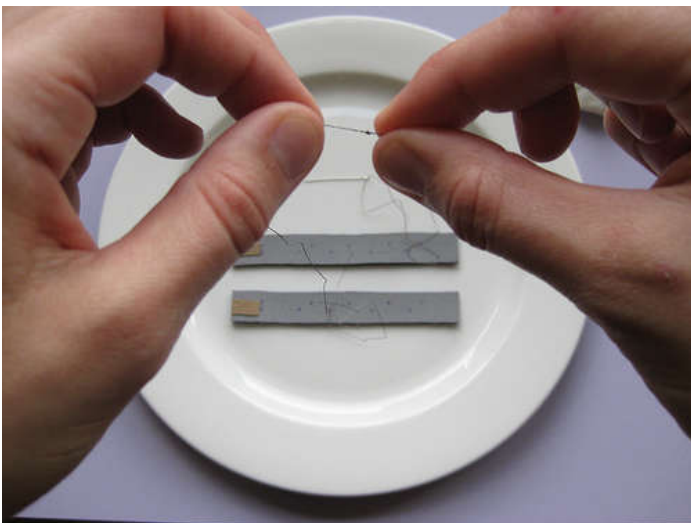
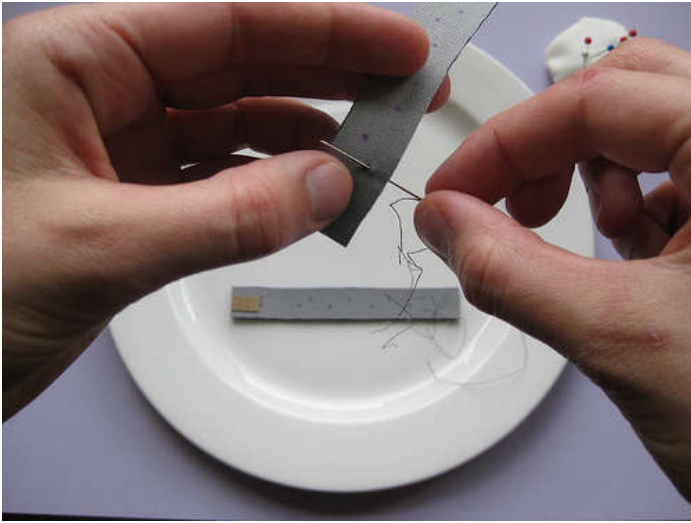
If you have not already fused interfacing to one side of your stretch conductive fabric, then you'll want to do that now. Now place the two pieces on top of the neoprene cutouts and fuse these together with an iron.

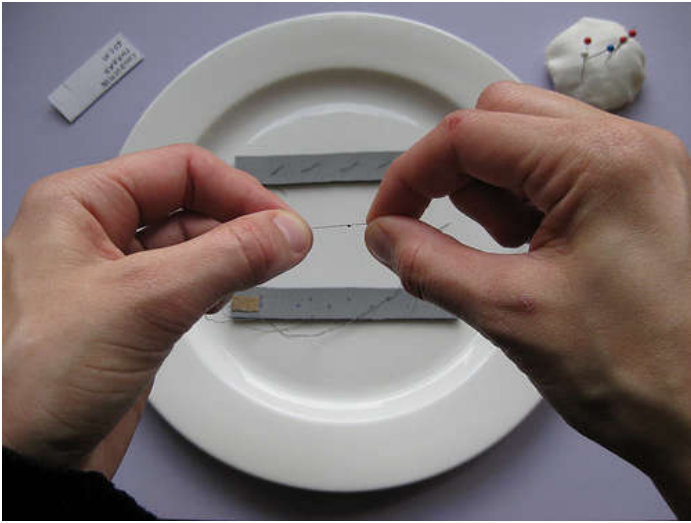


Step 4: Sewing

Thread a needle with about 50 cm of conductive thread (do not take it double) and stitch from the side into the first marked stitch hole and then make the four stitches and at the end connect to the stretch conductive fabric tab with at least five stitches. Cut the thread and repeat on the second piece of neoprene.

The reason the stitching on both sides must be identical is so that when they lie on top of each other (facing each other) the stitches crisscross and overlap in one point. This has the advantage that the stitches will be sure to cross (make contact at these points) and second that the point of contact is as small as possible. I've found that if the conductive surfaces are too big that the sensitivity of the sensor is no longer good for what I want.



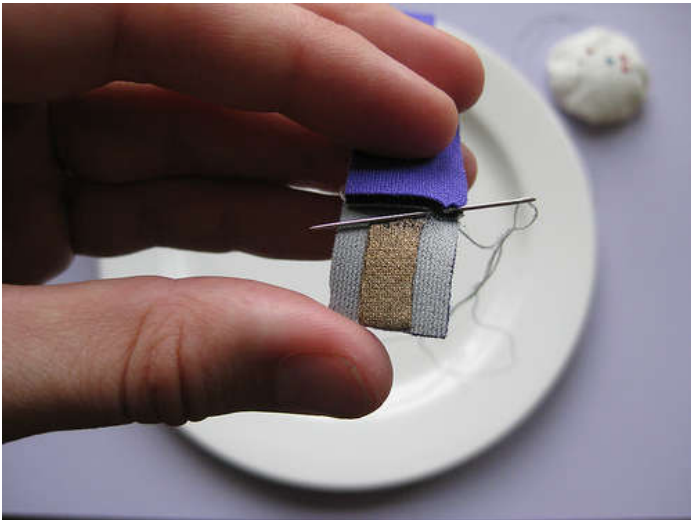




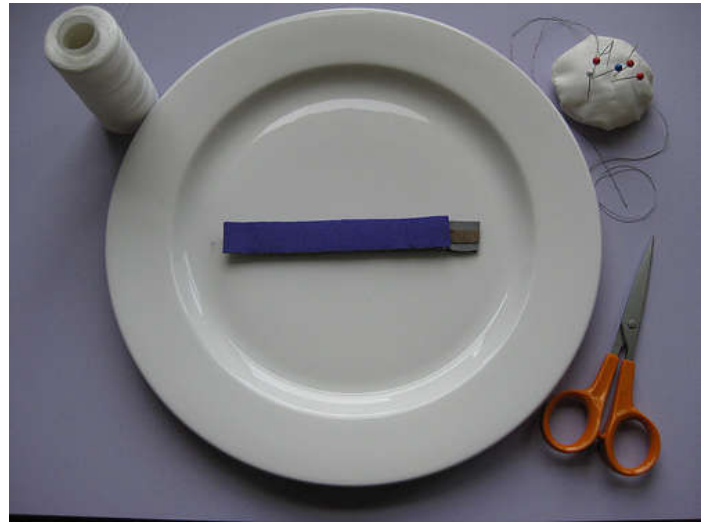
Step 5: Closing the sensor

Start sewing around the edges of the two neoprene pieces. Make sure to displace them by the 1.5 cm marked on the stencil. And dont forget to insert the two pieces of Velostat before closing the sensor all the way!!!

You can add more or less pieces of Velostat to control the sensitivity of the sensor.







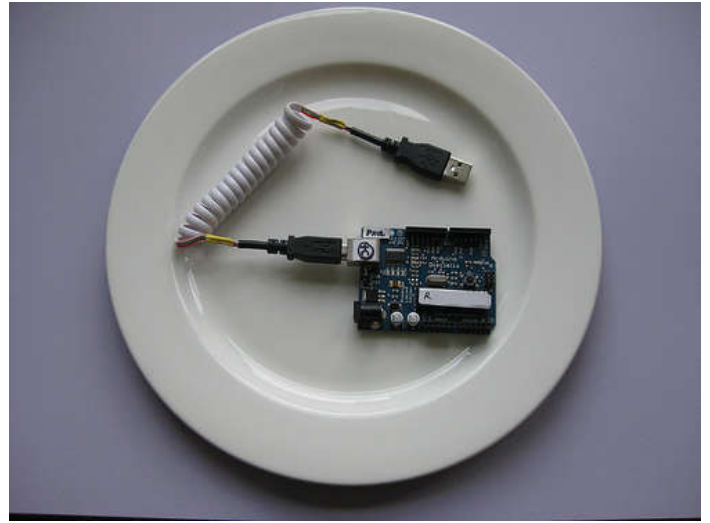
Step 6: Sheep's demo

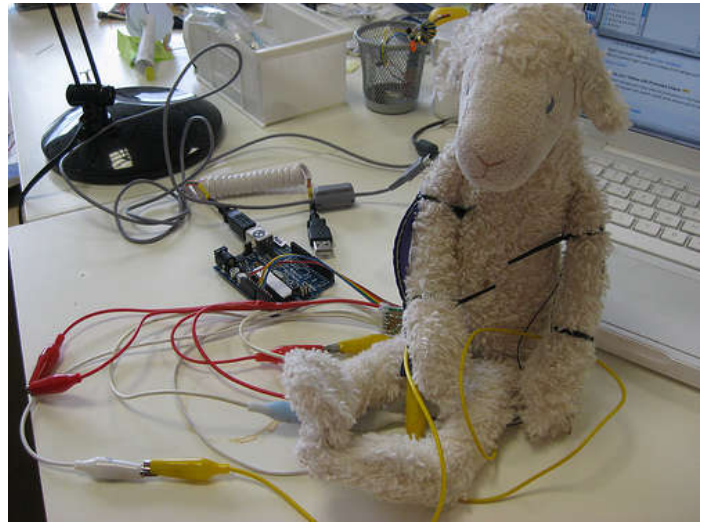
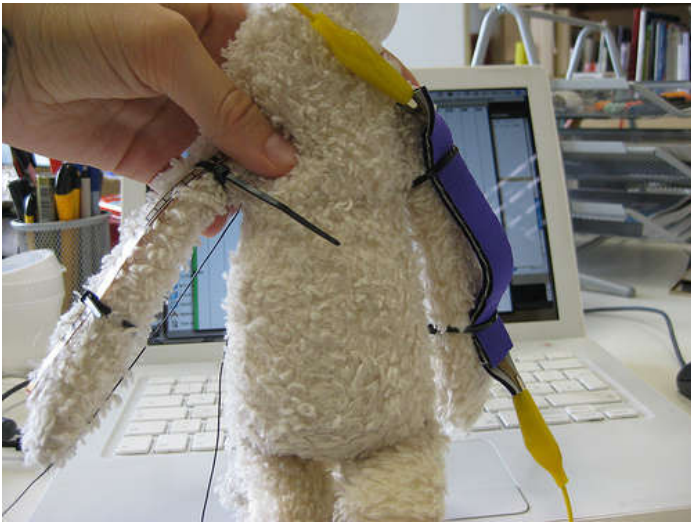
You are finished. To demonstrate that it works simply hook it up to a multimeter and set it to measure resistance (Ohm). Bend or press the sensor and the range should lie between 2K and 200 ohm.

You can also hook it up to your computer and graph the input. For this you will need to follow the instructions in the previous Fabric Bend Sensor Instructable (see step 7)

>>
http://www.instructables.com/id/Fabric_bend_sensor/

Let me know if you make one, I'd love to see some photos.
Enjoy!





Related Instructables



Fabric bend sensor (Photos)
by Plusea



Conductive Thread Pressure Sensor
by Plusea



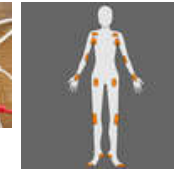
Fabric Bend Sensor
by Plusea



Stickytape Sensors
by Plusea



Pressure Sensor Matrix
by Plusea



Puppeteer Motion-Capture Costume
by Plusea

Comments

[30 comments](#) [Add Comment](#)



Capt.Phil says:

Hi, Was wondering if there was any household material that you know of that would provide the same function as velostat? If i'm right in assuming that we are using a conductive material to place inbetween the conductive thread would something like tin foil work?

Jan 9, 2011. 10:36 AM [REPLY](#)



Plusea says:

that is a great question. unfortunately i don't know of a household material that can replace velostat. aluminum foil won't work because it does not have piezoresistive properties (changes electrical resistance under pressure). but you could try using a porous material that allows for more or less contact depending on how hard you pressure it. let me k now if you find something that works!!!

Jan 9, 2011. 11:12 AM [REPLY](#)



Capt.Phil says:

I live in the uk and need only a small amount of velostat (or substitute). Do you know whether something like this would work?
<http://www.maplin.co.uk/Module.aspx?ModuleNo=396629>

Jan 9, 2011. 12:12 PM [REPLY](#)



Plusea says:

i have not had luck with the silver/transparent anti-static bags. you want to find a black one. try ordering linqstat from caplinq. it is the same as velostat.

Jan 9, 2011. 1:11 PM [REPLY](#)



Capt.Phil says:

Thanks for your quick replies, I will try and get hold of some soon and let you know how it all goes.

Jan 9, 2011. 1:41 PM [REPLY](#)



Capt.Phil says:

I managed to get hold of some (very similar to but not actually) velostat and after following your schematics managed to come up with sensors that work but there operating in the Mohm range....not really what I want. Any ideas why this might be? just due to the anti-static material?

Mar 24, 2011. 4:19 AM [REPLY](#)

I am trying to build a flex sensing glove to control a robotic hand that I am building currently. So any ideas would be greatly appreciated.



Plusea says:

yes, i think the high resistance range might likely be due to the velostat/substitute. try using conductive fabric (or aluminum foil) instead of the conductive thread on either side.

Mar 24, 2011. 6:30 AM [REPLY](#)



NicOmbra says:

Could you attach these to an electric key board's keys to play music by bending your fingers?

Jul 12, 2010. 5:08 PM [REPLY](#)



azdelblade says:

hi, first off, thanks for the brilliant instructable! i made one of these with all the components you listed here, neoprene and actual velostat. i can get readings off of my multimeter fine and change an led with a battery fine, but when i hook it up to my lilypad on a1 or a0, I only see changes between 1023 and 998, which is not much. I tried loosening up the stitches and using digital 5 as a power source instead of +, but it doesn't seem to help. Any suggestions? When I put my multimeter on 200k i get readings between 20 and 0.5. I tried adding 10k, 1M and 10M resistors, but that still didn't improve the sensitivity. I also tried adding another piece of velostat.

Jun 15, 2010. 2:03 AM [REPLY](#)



azdelblade says:

I was able to get a decent reading by making a voltage divider circuit, after looking at this lilypad flex sensor example: <http://mtifall09.files.wordpress.com/2009/12/rhinoglove.pdf>

Jun 15, 2010. 10:43 PM [REPLY](#)



antonino.secchia says:

Hello Hannah,
Great idea and Super instructables.
Have you some Ideas where is possible to find in Europe some sheets of EeonTex?
I'm working to construct some of this for one subject in my University in Italy, also connected to Arduino.
Thnx

Mar 24, 2010. 4:14 PM [REPLY](#)

Nino



Plusea says:

as far as i know you have to get in contact with eeonyx - who are based near san francisco - and they should be able to send you samples of their materials or otherwise let you purchase a small amount at a reasonable price.

Mar 25, 2010. 1:25 AM [REPLY](#)



pbates123 says:

Plusea -

Great demo and I love the display on your computer. I am interested in how you created the display is this a home made interface or something commercial??

Feb 8, 2010. 11:34 PM [REPLY](#)

Regards,



Plusea says:

if you check out the last step in this instructable it will lead you to a previous instructable that explains the details in step 8:
>> http://www.instructables.com/id/Fabric_bend_sensor/step8/Software-Visualization/

Feb 9, 2010. 5:24 AM [REPLY](#)

basically i'm using the free programming environment Processing to write a basic graph application and the code for that application can be downloaded from the link above.



jpe1456 says:

where on the eeonyx website can i request a sample

Jan 4, 2010. 4:25 PM [REPLY](#)



Plusea says:

Unfortunately they don't offer information on ordering samples or even small quantities, but you should be able to use the contact from on their website, or email to: info@eeonyx.com

Jan 5, 2010. 8:08 AM [REPLY](#)



Saint_Awesome says:

What specific kind of EeonTex fabric should I request for a sample for making sensors like this one?

Oct 7, 2009. 8:29 PM [REPLY](#)



Plusea says:

i think it was their EeonTex RL-5-137 SL-PA coated stretch fabric. or anythin similar to this one should work good.

Oct 8, 2009. 7:08 AM [REPLY](#)



gorgeous86 says:

Hi, i have already created a few bend sensors of the first version, but am still not satisfied about the result(s): the signal fluctuates too much... What i basically want is to combine stretch x bending of a persons t-shirts on the place of his back(spine?)whereby the sensors are placed horizontally in order to get better results. Someone can help me getting a better signal...? is it possible to only make a stretch sensor out of the conductive fabrics. The signal is basically influenced when the fabric is stretched, right? btw i am using MaxMSP instead of processing :) thank you very much, Gordon (utrecht, netherlands)

Jun 19, 2009. 9:42 AM [REPLY](#)



Plusea says:

Jun 22, 2009. 11:38 PM [REPLY](#)

the bend sensor works because pressure is exerted on the layer of velostat between the two conductive layers. if you stretch a strip of lessEMF's stretch conductive fabric you get a change in resistance by about half, when stretched fully. this might work as a stretch sensor for your. to get clearer readings try a low pass filter - insert a capacitor of 4,7uF - 10+uF parallel to your pull-up resistor >>
http://en.wikipedia.org/wiki/Low-pass_filter



Yingdan says:

May 31, 2009. 5:30 PM [REPLY](#)

I am trying to make one. Could you please tell me what type of neoprene you use? For HS 1.5mm, they have shark skin, open cell and smooth etc. many types. Thank you very much.



Plusea says:

May 31, 2009. 11:10 PM [REPLY](#)

the type is fused with standard polyester jersey on either side. you can choose whatever colours you like.



Yingdan says:

Jun 1, 2009. 3:56 PM [REPLY](#)

Never mind. I found some sources here too. Thanks again!



Plusea says:

Jun 2, 2009. 3:08 AM [REPLY](#)

glad you found a source in the US. maybe you could share it? sedochemicals delivers nicely within europe and shipping costs are relatively cheap, but for them to send to the US costs about 80USD in shipping.



Yingdan says:

Jun 2, 2009. 3:34 PM [REPLY](#)

The best website that I found is:
<http://www.hookloopoutlet.com/neoprene-sheets.html>



Yingdan says:

Jun 1, 2009. 12:48 PM [REPLY](#)

Thanks for quick reply. I checked your website and find you have been working on many interesting projects.

I sent inquiry to <http://www.sedochemicals.com/>, but have not got reply yet. It seems to me since the company is in Germany and I am in US, it might be impossible for me to get 2-3 sheets from them - is it true according to your experience? I have checked local stores and have not got satisfactory neoprene so far. Neoprene rubber seems not good enough.



giannichan says:

May 3, 2009. 2:50 PM [REPLY](#)

Hi, love your work. I'm thinking of using 8 bend sensors in my next project. I've got my own conductive thread and I've looked up the other materials you've provided links for. Only problem is they sell quantities way larger than I need. Do you know of any alternatives? At this point I'm just considering buying plain old pre made flex sensors. PS. I'm in the UK so shipping is an issue too : / Thnx for any help.



giannichan says:

May 3, 2009. 2:40 PM [REPLY](#)

Hey, I'm thinking of making a new kind of data glove. These sensors would be ideal. I'm only looking to use 8 sensors. I already have my own conductive thread and I've looked up the other materials on the sites you've suggested but it seems like they deal in large quantities that I don't really need. Do you know of any alternative sources for these materials? ps. I'm ordering from the UK so shipping is an issue for me too : /



AndyGadget says:

Apr 24, 2009. 12:18 AM [REPLY](#)

I was looking around for something I could make a pressure sensor with without resorting to a commercial strain gauge and this looks ideal. I've got some quantum tunnelling substrate tube which goes from several megohms to a few ohms with bending but this doesn't seem to be available any more and QTS is only available as small pads now (but not without possibilities). Your sensor is a better approach for an Instructable as the parts are easily available.



talk2myshirt says:

Apr 23, 2009. 7:15 AM [REPLY](#)

I am impressed again by the simplicity of this sensor and it's excellent performance compared to the commercial sample. Got to find time to build one myself hopefully soon. I love your presentation of the 'incredibles' to cook up this sensor - fabulous :D