**Paper Electronics Materials and Resources**

**The Basics**

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| **Copper tape** |  | * [www.amazon.com/inch-yds-Copper-Foil-Tape/dp/B00EY44I42/](http://www.amazon.com/inch-yds-Copper-Foil-Tape/dp/B00EY44I42/) * [www.sparkfun.com/products/10561](https://www.sparkfun.com/products/10561) * copper tape sold for stained glass making * "snail tape" from hardware stores |
| **“Coin cell” Batteries**  **size: CR2032**  **voltage: 3V** |  | * digikey.com, part number: [**P189-ND**](http://www.digikey.com/product-search/en/battery-products/batteries-non-rechargeable-primary/394467?k=P189-ND) * Anywhere that sells batteries   when you store these, don’t put them in a pile - if they touch, they can drain very fast! |
| **Surface-Mount LEDs**  **size: 1206** |  | * search for "1206 surface mount LEDs" and the color you want. * eg. [www.sparkfun.com/products/12621](https://www.sparkfun.com/products/12621) * or buy in bulk on Ebay (eg. [IC-Touch-Store](http://stores.ebay.com/IC-Touch-Store)) |
| **“Circuit sticker” leds** |  | * <http://chibitronics.com/>   Designed to be easier to attach than regular surface mount LEDs.  There are more kinds, including sensor stickers, effect stickers, and microcontroller stickers. |
| **Binder Clips**  **size: small** |  | * Office supply stores   Use to clip batteries onto corners of pages to connect them to your paper circuits. |
| **Clear Tape** |  | * Office supply stores   Use to attach surface mount components such as LEDs onto your copper tape traces. |
| **Cardstock** |  | * Art stores or Office supply stores * Sometimes we use regular index cards * Sometimes we get fancier! (eg. Borden & Riley 90lb is nice!) |

**TIP:** The keyword “Surface Mount” can help you find the small, flat version of many electronics components, not only LEDs! These are great for paper circuits.

**Programmable Circuits**

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| ATTiny micro-  controller |  | <http://www.digikey.com/product-detail/en/ATTINY85V-10PU/ATTINY85V-10PU-ND/735471?cur=USD> |
| TinyAVR programmer |  | <https://www.sparkfun.com/products/11460>  connects to your USB port and allows you to reprogram the Attiny microcontroller to blink LEDs, sense the world around it, and tons more! Getting started guide also at link above. |
| ATtiny installations |  | Installing Arduino <http://www.arduino.cc/en/Main/Software>  Attiny library for MAC <http://highlowtech.org/?p=1695>  Attiny Library Windows <https://learn.sparkfun.com/tutorials/tiny-avr-programmer-hookup-guide/programming-in-arduino> |

**Soldering Tools**

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| Soldering Iron |  | <http://www.jameco.com/webapp/wcs/stores/servlet/Product_10001_10001_217461_-1> (analog dial)  <http://www.jameco.com/webapp/wcs/stores/servlet/Product_10001_10001_233533_-1> (digital display)  These are the irons we use in class. You can buy with either an analog dial, or a digital display.  There are many cheaper models on the market too, just make sure you buy an iron that is 40-60watts |
| Tip Cleaning |  | <https://www.sparkfun.com/products/8966> (lead Free) |
| Solder |  | <https://www.sparkfun.com/products/9325> (lead free) |
| Brass Wool |  | <http://www.jameco.com/webapp/wcs/stores/servlet/Product_10001_10001_156777_-1> |

**Other conductive materials**

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| --- | --- |
| graphite paint | * Bare Paint (they also have some cool paper circuit tutorials!):<http://www.bareconductive.com/>   more resistive/less conductive than copper tape, which turns out to be great for making sensors. You can’t solder to it, but it dries a bit like a glue, holding parts in place. |
| Silver ink pens | * <https://123d.circuits.io/shop/circuitscribe>   You can’t solder to the ink, but there are examples of using conductive epoxy or magnets to attach parts. |
| Conductive fabric tape | <http://lessemf.com/fabric.html>  (scroll down to: Ni/Cu/Co Fabric tape)  Great for making folds that won't break over time (eg. inside book spines!) but trickier to solder to. |
| copper paint | Cu-pro Cote paint:<http://www.lessemf.com/paint.html> |
| silver ink: | <http://www.conductivecompounds.com/WB_101_Water_Based_Silver_Conductive_Ink.html> |
| thermochromic pigment powder | <http://www.paintwithpearl.com/colorchangestore.htm>  Thermochromic means: changes color with heat! (and you can make circuits that generate heat, for example by running current through thread that is slightly resistive). |
| fiber optic cable | <http://thefiberopticstore.com/purchase/endglowfilament.htm> |
| fiber optic fabric | <https://www.sparkfun.com/products/11594> |
| Conductive Thread | 400-500ft spoil <http://www.jameco.com/webapp/wcs/stores/servlet/Product_10001_10001_2144489_-1>  Smaller amounts -60ft spoil <https://www.adafruit.com/products/641>  Solderable thread  <https://www.etsy.com/listing/114198338/solderable-conductive-thread-thinner?ref=shop_home_active_5> |

**Tutorials and websites**

- This handout (the one you are now reading!) <http://tinyurl.com/mkq2jr6>

- Chibitronics tutorials: <http://chibitronics.com/education/>

- 21st Century Notebooking Project: <http://www.nexmap.org/21c-notebooking-io/>

- E-lluminated Books how-to: <http://tinyurl.com/mtpfzja>

- Paper battery holder by Jie Qi:

- Video Tutorial: <https://www.youtube.com/watch?v=j0xXTB4Be8Q>

- Template: <http://web.media.mit.edu/~jieqi/downloads/4_battery_holders.pdf>

- High-Low Tech Group at MIT:

- LED dragon kites (<http://hlt.media.mit.edu/?p=1414>)

- electronic origami flapping crane (<http://hlt.media.mit.edu/?p=1448>)

- painted circuits (<http://hlt.media.mit.edu/?p=1376>).

- Kit-of-no-parts: Fantastic starting point if you want to experiment with lots of materials:<http://kit-of-no-parts.at/>

**Project I[nspiration](http://learn.adafruit.com/getting-started-with-flora/)**

[- El](http://learn.adafruit.com/getting-started-with-flora/)ectronic Popables by Jie Qi: <http://www.youtube.com/watch?v=AI-6wMlaVTc>

[- Shadowboxes and animations by Becca Rose:](http://web.media.mit.edu/%7Eplusea/) [blog.beccarose.co.uk/2014/07/09/whats-in-the-box/](http://blog.beccarose.co.uk/2014/07/09/whats-in-the-box/) + many more

[- Tide Notebook by Natalie Freed](http://thefiberopticstore.com/purchase/endglowfilament.htm) with NEXMAP:

[www.nexmap.org/blog/2014/4/1/meet-the-wi-fi-connected-notebook](http://www.nexmap.org/blog/2014/4/1/meet-the-wi-fi-connected-notebook)

- Pu Gong Ying Tu by Jie Qi: [technolojie.c](http://technolojie.com/pu-gong-ying-tu-dandelion-painting/)[om/pu-gong-ying-tu-dandelion-painting/](http://thefiberopticstore.com/purchase/endglowfilament.htm)

[- Telescrapbook by Na](http://thefiberopticstore.com/purchase/endglowfilament.htm)[talie Freed, Jie Qi,](http://web.media.mit.edu/%7Eplusea/) [Adam Setapen: nataliefre](https://www.sparkfun.com/products/11594)[ed.com/telescrapbook/](http://www.nataliefreed.com/telescrapbook/)

[- Pulp-based Computing by Marcelo Coehlo:](http://web.media.mit.edu/%7Eplusea/) [web.media.mit.edu/~marcelo/paper/index.html](http://web.media.mit.edu/%7Emarcelo/paper/index.html)

[- Fold Loud by JooYoun Paek:](http://web.media.mit.edu/%7Eplusea/)<http://rhizome.org/editorial/3685/>

[- Anabiosis: color-changing butterflies by Akira Wakita Lab:](http://web.media.mit.edu/%7Eplusea/)<http://metamo.sfc.keio.ac.jp/project/anabiosis/>

[- Paper speakers by Hannah Perner-wilson:](http://web.media.mit.edu/%7Eplusea/)<http://hlt.media.mit.edu/?p=1372>

**Electronic textiles (sewable electronics) materials and resources:**

- Sewable battery holders:<http://search.digikey.com/scripts/DkSearch/dksus.dll?Detail&name=BA2032SM-ND>

- conductive thread: <https://www.sparkfun.com/search/results?term=conductive+thread&what=products>

- conductive fabric: <https://www.sparkfun.com/products/10056>

- sewable microcontrollers, sensors, and other components:

- LilyPad Arduino: <https://www.sparkfun.com/categories/135>

- Flora: <http://www.adafruit.com/products/659>

Tutorials:

- LilyPad:<http://lilypadarduino.org/>

- Flora: <http://learn.adafruit.com/getting-started-with-flora/>

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