

Eliminating paper is a

MIXED BAG

Paper is one of the most interesting materials created by humanity.¹ It can be produced in many forms and has just as many or more applications. Paper is used for written communications, for archiving our thoughts and ideas and memories, for photography as well as art, for storage and transportation of our possessions, for cash, for envelopes and postage stamps, for wiping surfaces and materials, as tissues for sneezing, as toilet paper for—well, you know—for TPing your neighbor’s house when they don’t give good treats at Halloween. Not that I would know anything about this, much less participate in such a heinous crime. There are too many applications of paper to enumerate.

The problem is that production of paper is a messy process using toxic chemicals and producing a stench like that from gaseous sulfur compounds (rotten eggs) that can be smelled many miles away from the plant. From where I grew up in southeast Arkansas in the United States, there was a paper mill about 50 miles away to the north. When the wind would blow in from the north, the stench would bother us all until the wind direction shifted.

Paper waste remains an issue. Although efforts have been extended by most municipalities to recycle paper, we still have to produce paper from the original source—mostly from trees. How many of you have been confronted at a copier or printer after copying or printing a large document, only to be called a “Tree killer!” by narrow-minded folks concerned about the loss of trees on the environment and the impact on global climate change?² Come on—be honest with yourselves. I know I’m not the only one.

Long, long ago (2011) in a land far, far way (California), I wrote an *MRS Bulletin* POSTERMINARIES article³ lamenting the use of paper and indicating that I looked forward to the time when many of the applications just mentioned would be replaced with applications in electronic format, including eReaders for written text, graphics, photographs, and other

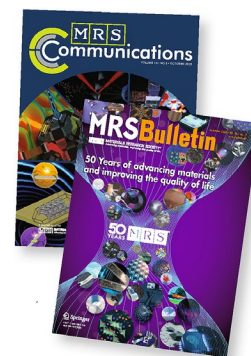
forms of information. So, here we are more than 10 years down the road. How did that turn out?

I used to read the *LA Times*⁴ (every day), the *Daily Breeze*⁵ (every day), and my hometown newspaper (weekly) in print format. This resulted in significant paper waste as well as dirty hands from the transference of the printer’s ink from the papers to my hands. I stopped the first two, but not my hometown newspaper, which I still receive in print form. I get my news from news apps, primarily *USA Today*,⁶ the BBC,⁷ and the news threads on my devices, as well as a number of other sources. Between that and news from various television sources, and news from technical society magazines, I don’t feel that I’m missing anything important.

For books for my own reading, I only read fiction on my Kindle or iPad. I’ve become accustomed to the process and don’t feel that I lose anything relative to a bound volume (either hardcover or paperback. Technical books are another story. For a while, I stopped buying print volumes and only bought technical books for my Kindle or iPad. However, the experience there was less than what I desired. Many times the equations and figures did not translate well so that it made it difficult to follow the text. After a couple of years of trying this approach, I reluctantly went back to buying my technical books only in print format (either hardcover or paperback) and I continue that to this day. Maybe, 10 years or so from now, I’ll write yet another POSTERMINARIES article on this subject and be able to report that I’m able to view and read technical books in electronic format with the same effectiveness as reading the print copy. (Sigh—one can only hope!)



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Most of the journals that I read, including journals from the Materials Research Society (MRS), are available electronically. If you are reading this, it is likely that you are a member of MRS. I hope that you know that one of the benefits of MRS membership is free access to all of the MRS journals. Although you can still get a print copy of *MRS Bulletin* if you pay extra for a print subscription, most dissemination is electronic. Some of my colleagues who are longtime members of MRS grumble about this. They greatly prefer the print copy. Six years or so after I wrote the 2011 article, I retired, which means that I no longer have access to most of the journals that I could access before retirement. Professionally, this is a huge barrier. Fortunately, there is a burgeoning virtual library of open access journals, as well as open access articles in journals that are not primarily open access. Open access is enabled by the Internet. I can't imagine how open access could work without the Internet.

I review articles for journals and serve as an associate editor for one journal as well as serving on the editorial board of *MRS Bulletin*. All of the journals of which I am aware have an electronic tool that allows editors to receive submissions via the Internet. The submissions to the editor-in-chief are then distributed to other editors and finally to reviewers. Prior to the Internet, this process could take months, whereas now the distribution is essentially instantaneous. Of course, there are still delays while selected reviewers try to decide whether they have the expertise, the time, and the inclination to provide the review. But, overall the process is faster. Alas, when I receive a manuscript to review or serve as editor, I print a copy. I then proceed to mark up the hard copy before transferring that information to the tool along with my recommendation. There are tools available that would make electronic markup easier, but those markup tools have not been implemented in any of the reviewer or editorial tools that I am aware. I use a lot of paper in this work. Sigh—I hope that 10 years or so will change this.

Each year I send out many Christmas cards, Valentine's Day cards, birthday cards, and other cards. I am reluctant for various reasons to use ecards, so I almost always send paper cards. Sending an ecard just doesn't seem as personal, although I'm not beyond using an ecard if I'm really, really late.

I don't use cash as much as I used to and now pay for most transactions with my credit card or debit card. However, I keep receipts for most of those transactions, and the receipts are mostly paper. In order to keep my files from overflowing with these paper receipts, I get rid of them after three years. Similarly, I receive bills for expenses mostly in paper form. I have set up electronic bill-pay within my banking app and



pay almost all my bills electronically. I find this faster, more secure, and it saves on postage.

How about carrying food home from the grocery store? Many stores used to use paper bags at checkout. Most of them have gone away from that in favor of plastic bags. However, many manufacturers package their products in paper boxes and paper bags. So, even if you get plastic bags at checkout, they wind up filled with paper of one form or another, most of which winds up as waste. Furthermore, plastic bags create their own environmental issues. If you follow this concern then you know that our oceans, lakes, rivers, and streams are overflowing with

plastic, much of it in the form of plastic bags.⁸ Microplastic and nanoplastic materials⁹ seem to be everywhere and ecologists are just beginning to understand the sources of the nanoplastics and their effects on human health.¹⁰ The real answer for bags at checkout is to bring your own reusable tote bags made of cloth. Alas, although I have several suitable tote bags, I often forget to take them with me when I go shopping.

Overall, my attempts to eliminate paper and the associated paper waste have been a mixed bag. No pun intended. I am surrounded by thousands of books in print format. I have reams of paper for printing, scanning, and copying. I have numerous files filled with information on paper. I receive and send mail using envelopes and containing sheets of paper many times during any given month. Much of the paper mail that I receive is junk mail. I would love to find a way to stop receiving junk paper mail that doesn't just confirm that someone lives at this address.

As I mentioned, if I look ahead, maybe I'll be invited to address this topic again 10 years or so down the road. Maybe, at that time, many of these problems will have been solved. Perhaps some of us in the materials research community will find ways to make recycling more effective, or to make waste from paper and plastics more biodegradable.

Steve Moss

Endnotes

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