Raising a Materials Racket

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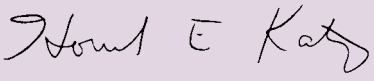

Greetings, sports fans. The month of June is marked by numerous athletic happenings, though one in particular has always struck me as the quintessential June event. Not the basketball or hockey playoffs; for most people with rooting interests (and all of those without), those sports are yesterday's news. The soccer football season in countries with traditional league schedules is long since over. The baseball season is transitioning from the optimism of opening week to the relative drudgery of the dog days of summer. No, my favorite June sports happening has always been the Wimbledon tennis tournament, beginning June 21 at the All England Lawn Tennis & Croquet Club. This event combines the ruthless win-at-all-costs competitive atmosphere of a major sports championship with the lush green setting, brilliant blue skies (every other day at least), and succulent strawberries of the season. One can alternately fantasize about possessing the superhuman strength and agility to advance through the tournament and living the life of royal contentment exemplified by the ambience of the box seats and courtside restaurants.

Tennis is a sport that has been completely revolutionized by advances in materials research. From the inception of the modern rules until the 1960s, tennis rackets were made of wood. The racket that I used as a child differed little from one that I once found in an uncle's garage that he had used decades earlier. Wood rackets suffered from structural weakness, high weight, and an annoying tendency to break on short time scales (e.g., immediately on impact with a net pole or fence post). In the late 1960s, metal rackets were introduced, first steel and then aluminum, and with the example set by the great Jimmy Connors, metal became the material of choice. His famous steel-framed T2000 model, which was also used by numerous other players of all skill levels, would eventually be termed "trusty," although its reign covered less than 20 years. It lasted so much longer than a wood racket that it adversely impacted racket sale revenues. The T2000 is now remembered so fondly that it is a collectors' item.

The real revolution came as the result of the use of composite frames. These composites have been formulated with a wide variety of materials, including fiberglass, aluminum, graphite, titanium, and carbon fiber. The French company Nanoledge even proposes carbon nanotubes as a racket constituent! These materials, along with newly possible frame designs, enabled even novice players to bang out serves and lance volleys. While greatly increasing the number of people physically able to carry on a competent game of tennis, these advances in racket frame materials made the shots of championship-caliber players seem to be out of this world.

The incorporation of high-tech materials has not been limited to racket frames. For example, the Wilson Double Core tennis ball, the official ball of the Davis Cup international team tennis championship, is made from a nanocomposite of butyl rubber and vermiculite clay. The clay can be exfoliated into molecule-thick sheets, which form a tortuous path through the rubber that greatly slows the depressurization of the balls and preserves their bounce. The composite is made by a patented water-based process of dispersing microparticles of the rubber with the exfoliated clay, developed by InMat LLC of Hillsborough, N.J.

In a recent Davis Cup match against Jonas Bjorkman, Andrew Roddick unleashed a world record 152 mile per hour serve. His standard racket of choice, according to his own Web site, is made of a graphite–Kevlar composition, and he was presumably swatting the ultramodern tennis balls described earlier. What a powerful demonstration of the engineering of a materials system to bring human performance to a new pinnacle! At the same time, we observe a further increase in the gap between the majority of us rank hackers and the true professionals. Fortunately, we can take comfort in knowing that the developers of all of these supermaterials had to have been true professionals as well.

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