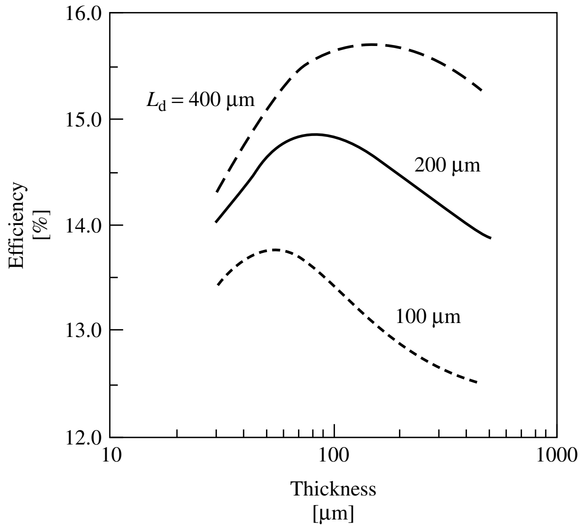

Figure 6.27 Solar cell efficiency versus thickness. (See the text for a description of the solar cell parameters)

The thickness of WEB and SF is closer to the optimum than the other three ribbon growth techniques. Light trapping will move the optimum to a thinner base, but such optical structures on multicrystalline ribbon are not yet practical. For growth on a substrate, it is possible to texture the substrate to trap light. This has been shown on SF wafers [57].

Solar cell fabrication processes used for conventional Cz and cast material wafers are commonly applied to silicon ribbon. If the ribbon is doped *p*-type with boron, the *n*-type emitter typically is formed by phosphorus diffusion either from $POCl_3$, PH_3 or a spin-on source. Front contacts are usually screen-printed or evaporated with diffused or alloyed aluminium as back contact to produce a back surface field. A double or single layer anti-reflection coating may be used. For SF grown on an insulating substrate, contact with the back surface requires etching holes to allow contact with the conducing barrier layer. Table 6.6 summarises material characteristics and solar cell performance potential of the various forms of ribbon material. Boron dopes the ribbon *p*-type. Antimony can be used to produce *n*-type material as reported for WEB.

Table 6.6 Some "best" solar cell efficiency levels for various ribbon technologies

Material	Resistivity [Ω cm]	Carbon [1/cm^3]	Oxygen [1/cm^3]	Efficiency [%]
EFG (Reference [66])	2–4, *p*-type	10^{18}	$<5 \times 10^{16}$	15–16
WEB	5–30, *n*-type	Not detected	10^{18}	17.3
STR	1–3, *p*-type	4×10^{17}	$<5 \times 10^{16}$	15–16
SF (Reference [67])	1–3, *p*-type	5×10^{17}	5×10^{17}	16.6
RGS (Reference [68])	2, *p*-type	10^{18}	2×10^{18}	12.0