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Stopped light in a cylindrical waveguide with metamaterial YAN LING XUE[1], WEI LIU, YIWEI GU, East China Normal University, SCHOOL OF INFORMATION SCIENCE AND TECH TEAM — The unique property of the novel type of left-handed material (LHM) is that it can support propagating wave with the group velocity and Poynting vector opposite to the wave vector. We propose a cylindrical waveguide with its core and cladding filled with right-handed material (RHM) and LHM, respectively, to investigate the sign-varying energy fluxes and their cancellation and to explore the new mechanism of stopping light. The normalized total energy flux is introduced as $P = \frac{P_1+P_2}{|P_1|+|P_2|}$ where P_i (i =1,2) is the power confined in the waveguide core and cladding, respectively. There exist three situations: (1) $P > 0$ means $P_1 > |P_2|$; the propagation is in the forward mode; (2) $P < 0$ implies $P_1 < |P_2|$; this is the condition for the backward wave; (3) $P = 0$ means $P_1 = |P_2|$; the energy fluxes in core and cladding fully cancels each other, the light-wave propagation comes to a complete standstill with the group velocity reducing to zero, and the energy is stored in the waveguide completely. For modes TE_{0n} and TM_{0n}we theoretically derive the expression of the normalized energy fluxes. As $\mu_2 < 0$ means the energy flux in the LHM cladding is negative, opposite to the phase velocity, the energy fluxes between the RHM core and LHM cladding may cancel each other. The total energy flux thus becomes zero. The numerical simulation shows that with appropriate electromagnetic frequency and waveguide core radius, the electromagnetic waves can reach a complete standstill. We consider two popularly used Drude models in the microwave and optical domains.

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