Bratkovsky and Levanyuk Reply: The main new result of our paper [1] is that the ferroelectric (FE) with the dead layer of thickness d is *always* split into domains, no matter how thin the layer is. We have found that the width of the domains a depends exponentially on d^{-2} when the dead layer is thin. We have also evaluated the response of the structure to external field (Fig. 2 in [1], and Ref. [2]). In the Comment [3] Tagantsev has tried to interpret our approximate Eq. (14), which he misrepresented as the main result of the Letter, within the "capacitors in series" model, by assuming that the dielectric constant of the FE is infinite, $\epsilon_f = \infty$.

However, Tagantsev has failed to notice that ϵ_f, as found in the "capacitor" model, is not infinite, but finite and actually *negative.* Indeed, a simple calculation in the capacitor model gives [2]

$$\epsilon_f = \epsilon_c \frac{1 + 4\pi P_a l/(\epsilon_c U)}{1 - 4\pi P_a d/(\epsilon_g U)} < 0, \qquad (1)$$

where P_a is the *net* spontaneous polarization, and U the bias voltage, with notations from [1]. Since always $P_a/U > \epsilon_g/4\pi d$, we have $\epsilon_f < 0$ [1,2]; see Fig. 1. In spite of this the system remains stable. ϵ_f in (1) is the nonlocal quantity due to long range Coulomb interaction, which makes the dielectric response rigid even when the FE itself would have a negative "dielectric constant" (cf. Ref. [4], Fig. 1). Thus, the "one-dimensional" model, advocated in the Comment, deals with obscure quantities without much physical meaning. Note also the incorrect claim [3] that the restoring force on unpinned domain walls in our model is identically zero. In fact, shifting of the domain walls would create the net electric field in the capacitor, and its energy is a source of finite stiffness of the domain pattern, even when the walls are *not pinned,* as is known since 1960 [5]. Note that the actual divergence of ϵ_{eff} is *much* stronger than that predicted by the capacitor model [6], Fig. 1, when the dead layer is thin and the domains are wide, $a \gg a_K$ [1,2].

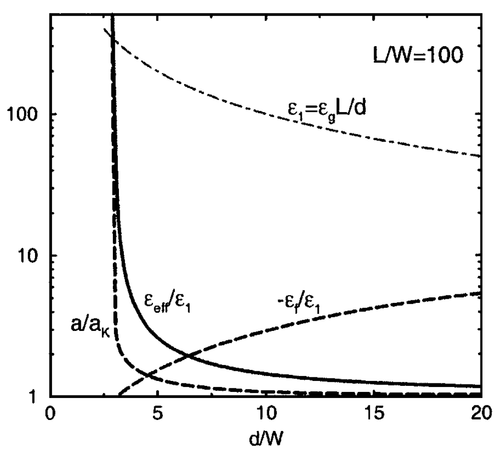

FIG. 1. The dielectric constants of the ferroelectric with the dead layer of thickness d (W is the domain wall thickness), a_K the Kittel domain width [1,2]. The "dielectric constant" of the FE layer is *negative,* $\epsilon_f < 0$. Note an abrupt increase in the effective dielectric constant of the capacitor ϵ_{eff} in comparison with $\epsilon_1 = \epsilon_g L/d$ [$\epsilon_{\mathrm{eff}} \approx \epsilon_1$ results from the "capacitor" model with the (incorrect) assumption $\epsilon_f = \infty$ [3]].

The equilibrium values, calculated in [1,2], set the upper limit for a tilt of the hysteresis loops. Its value is reasonable in comparison with experiment. We showed that the presence of the dead layer would drastically change the response. This is very different from the approach of Tagantsev, which tacitly implies that the FE layer can be characterized by some "intrinsic" hysteresis loop, which it cannot, and the only changes in the *observed* loop come from the voltage drop across the dead layer. Tagantsev has also misrepresented his work [9] in the Comment, as having something to do with the problem of fatigue. First, it does not, since it contains speculations about possible origins of "Nb effect," i.e., the modification of the loops with increasing doping of FE film by Nb. Second, those speculations are based on rather arbitrary assumptions about the relation between the doping level and pinning of the domain walls, etc.

We think that our consideration [1,2] clearly demonstrates a danger of applying a naive electric circuit analysis [3] to FE systems where the addition of one "circuit element" (dead layer) radically changes the electric response of the other, FE layer. It is not surprising, therefore, that such an approach cannot explain a fatigue observed in FE films. Certainly, there might be various reasons for the fatigue in FE capacitors. We simply submit that our mechanism gives a correct order of magnitude for the tilt of the hysteresis loops; therefore the growth of passive layer might indeed be the main source of fatigue.

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[6] It was noted in Ref. [3] in [2] that the implication $\epsilon_{\mathrm{eff}} \approx \epsilon_g L/d \to \infty$ for $d \to 0$ is incorrect, being invalidated by the breakdown of their approximations in this region (cf. Ref. [2]). Note also some missing terms in their expression for the free energy.

